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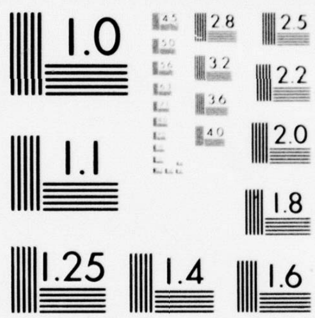
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PASSAIC RIVER BASIN

PEQUANNOCK RIVER, PASSAIC COUNTY

NEW JERSEY

COLD SPRING LAKE DAM

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NJ 00226

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106
AUGUST 1978

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

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Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

28 SEP 1978

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Cold Springs Lake Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance. Cold Spring Lake Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure, as a result of this inspection, is judged to be in fair overall condition. However, the spillway is considered inadequate since 11 percent of one-half the Probable Maximum Flood (½ PMF) would overtop the dam. This dam has performed adequately since 1904 without failure or evidence of instability. To insure continued adequacy of this dam, the following actions, as a minimum, are recommended:

a. The adequacy of the spillway should be determined by a qualified professional consultant, engaged by the owner, using more sophisicated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calenday year 1979. In the interim, a detailed emergency operation plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, the following actions should be implemented.

NAPEN-D
Honorable Brendan T. Byrne

(1) Engineering studies and analyses should be performed to determine the engineering properties of the foundation and the structural stability of the dam. Also, an as-built plan of the dam should be prepared at the same time. Any remedial measures, found necessary, should be initiated within calendar year 1979.

(2) A program should be developed to monitor the seepage through and under the dam. Depending on the information this program provides, the need for corrective measures can be considered and, if necessary, undertaken within calendar year 1979.

(3) The downstream waterway below the concrete spillway should be cleared of brush and debris.

c. No additional mortar should be added to the face of the masonry dam. Sealing the wall will alter the free draining characteristics of the wall and could allow for a build up in hydrostatic pressure at the back of the wall.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Robert A. Roe of the Eighth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia, 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely yours,

James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Cy Furn:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
P.O. Box 2809
Trenton, New Jersey 08625

Cold Spring Lake Dam (NJ00226)

Corps of Engineers Assessment of General Conditions

This dam was inspected on 27 & 28 June, & 7 July 1978 by Harris - ECI under contract to the State of New Jersey. The state, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, P.L. 92-367.

The Cold Spring Lake Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure, as a result of this inspection, is judged to be in fair overall condition. However, the spillway is considered inadequate since 11 percent of one-half the Probable Maximum Flood (½ PMF) would overtop up the dam. This dam has performed adequately since 1904 without failure or evidence of instability. To insure continued adequacy of this dam, the following actions, as a minimum, are recommended:

a. The adequacy of the spillway should be determined by a qualified professional consultant, engaged by the owner, using more sophisicated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1979. In the interim, a detailed emergency operation plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, the following actions should be implemented.

(1) Engineering studies and analyses should be performed to determine the engineering properties of the foundation and the structural stability of the dam. Also, an as-built plan of the dam should be prepared at the same time. Any remedial measures, found necessary, should be initiated within calendar year 1979.

(2) A program should be developed to monitor the seepage through and under the dam. Depending on the information this program provides, the need for corrective measures can be considered and, if necessary, undertaken within calendar year 1979.

(3) The downstream waterway below the concrete spillway should be cleared of brush and debris.

c. No additional mortar should be added to the face of the masonry dam. Sealing the wall will alter the free draining characteristics of the wall and could allow for a build up in hydrostatic pressure at the back of the wall.

Approved: James G. Ton
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

Date: 28 Sep 78

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Cold Spring Lake Dam, I.D. NJ00226
State Located:	New Jersey
County Located:	Passaic
Stream:	Tributary to Pequannock River
Date of Inspection:	June 27 & 28, and July 7, 1978

Assessment of General Condition

The general condition of Cold Spring Lake Dam is fair.

The general safety of Cold Spring Lake Dam is considered questionable in view of its lack of spillway capacity to pass one-half the PMF or even the 100-year flood without overtopping the dam. The spillway is capable of passing a flood equal to 10% of one-half the PMF.

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam.

The following remedial actions, therefore, are suggested along with a timetable for their completion.

1. Studies to augment the spillway discharge capacity should be undertaken within six months.

2. A program for regularly observing seepage should be implemented within six months.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within a reasonable period of time.

1. A program should be developed to monitor the seepage through and under the dam. Depending on the information provided, the need for corrective measures can be considered and, if necessary, undertaken.

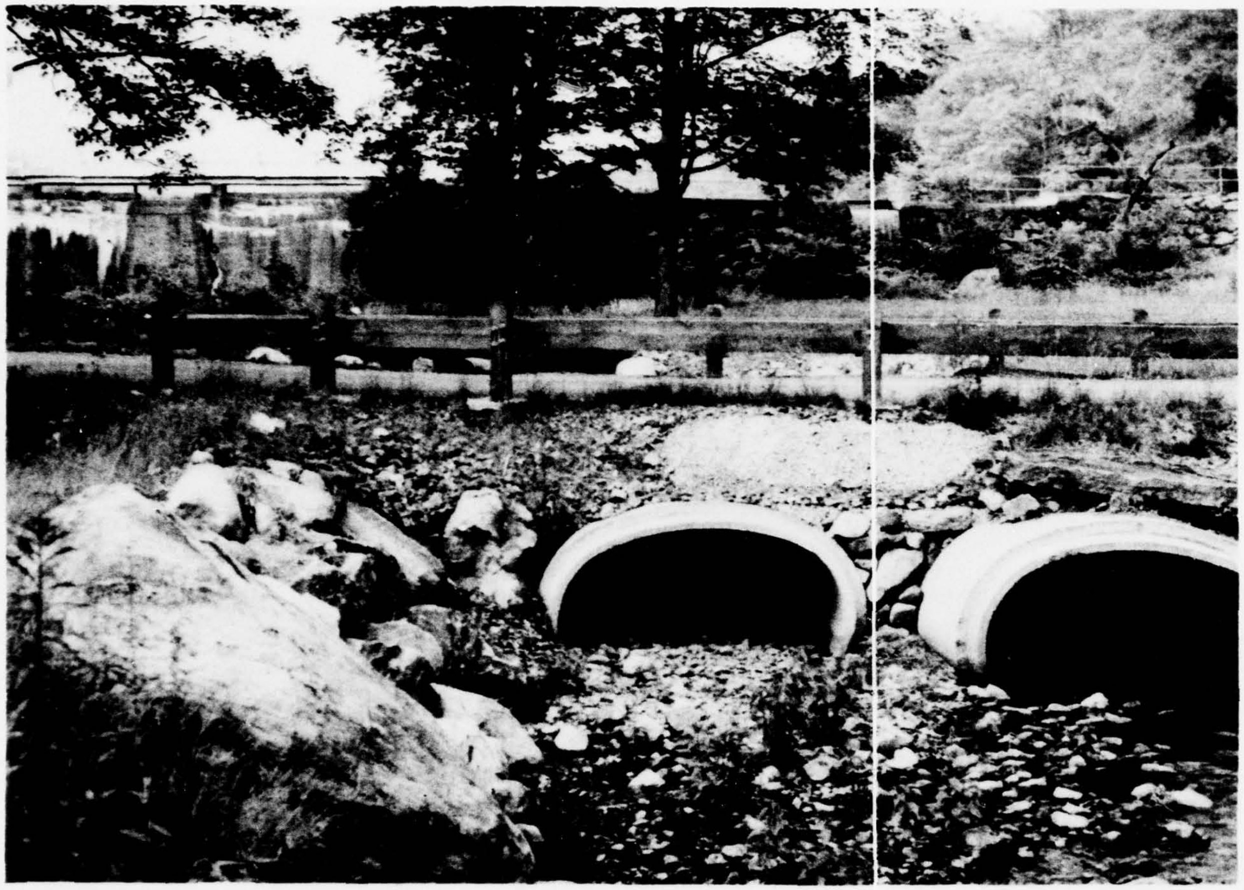
2. The downstream waterway below the concrete spillway should be cleared of brush and debris.

3. No additional mortar should be added to the face of the masonry dam. Sealing the wall will alter the free draining characteristics of the wall and could allow for a build up in hydrostatic pressure at the back of the wall.

Robert Gershowitz P.E.

Robert Gershowitz, P.E.

STATE OF NEW JERSEY
ROBERT GERSHOWITZ
20812
LICENSED
PROFESSIONAL ENGINEER



June 27, 1978

COLD SPRINGS LAKE
Rock masonry and concrete dam sections each with spillway, discharge channel culverts in foreground.

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

COLD SPRING LAKE DAM, ID. NJ00226

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of the Cold Spring Lake Dam was made on June 27 & 28, and July 7, 1978. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the Field Inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

The *original Cold Spring* Lake Dam, which remains in large part, is a masonry faced earth dam. The section probably consists of a gravity type retaining wall constructed of drywall rock masonry which supports compacted earthfill. The dam has a slightly curved axis and the downstream face of the retaining wall slopes back at about 1/4 horizontal to 1 vertical. The crest of the rock wall is about 5 feet wide and is mortared over. The earthfill extends about 9 feet behind the wall at the crest. The wall was originally constructed without mortar, but at some point in time, mortar was placed between the stones in the portions to the right and to the left of the spillway. It was orally reported by Mr. John Sisco, the previous owner, that a clay core has been installed behind the rock wall. Also, a concrete apron has been added at the base of the original section to protect against erosion. A concrete cap has also been constructed over the original spillway.

In 1903, the right abutment of the dam washed out when an upstream dam failed. The abutment was repaired with a curved concrete gravity section. The downstream face of the concrete section slopes back about 1/4 horizontal to 1 vertical. Earthfill has been placed up to the spillway crest on the upstream side.

The entire dam, as it exists today, is approximately 300 feet long with a maximum height of about 14 feet.

Gravel, sand and silt in low terrace deposits are exposed in road cuts east of the left abutment. It is believed this material extends to the left abutment and is the foundation for the dam.

The low level outlet works consists of a 12 inch diameter cast iron pipe under the original dam. The outlet is controlled by a gate valve in a manhole on the upstream side of the earthfill. The valve is operated manually, from the top of the manhole, using a long stem valve wrench. The inlet was orally reported to lay on the lake bottom and to have a screen over the pipe. The outlet is submerged in the spillway discharge channel. A cast iron pipe siphon is visible exiting from the dam near the middle buttress and plunging into the foundation downstream of the toe. It was reported that the siphon has been abandoned for about 10 years. Recent construction for the Star Lake Camp has covered the siphon outlet which could not be found, even by the previous owner.

Both sections of the dam have unregulated two-level overflow spillways in each section. The lower level in the rock masonry dam spillway is the normal discharge outlet. Only the lowest section of the rock masonry dam spillway has a small wooden footbridge over it. The entire spillway in the

concrete section has a wooden footbridge over it on concrete piers. A handrailing on the downstream edge of the crest extends along the entire length of the dam.

b. Location

Cold Spring Lake Dam is located in Passaic County, New Jersey. It is accessible by way of Macopin Road. The damsite is on the property of the Star Lake Camp. There is a private road access below the dam and to both abutments.

c. Size and Hazard Classification

Cold Spring Lake Dam is classified in the dam size category as being "small", since its storage is less than 1,000 acre-feet and its height is less than 40 feet. Only an abandoned industrial building and a secondary road exist between the dam and the Pequannock River. Since the town of Butler is approximately one mile downstream of the dam on the Pequannock River the failure of the dam is not likely to cause extensive loss of life or excessive property damage, a hazard potential classification of "significant" has been assigned to the project. The dam was originally rated "high" hazard, but was downgraded after the Field Inspection of the downstream area.

d. Ownership

Cold Spring Lake Dam is owned by the Star Lake Camp, Salvation Army, 50 West Twenty-Third Street, New York, New York, 10010, Attention Major Thomas Adams, General Secretary for Business and Properties.

e. Purpose of Dam

The lake is used only for sport and recreation, mostly swimming, boating and fishing activities in conjunction with summer camp activities.

f. Design and Construction History

It was reported orally by the previous owner, Mr. John Sisco, that the original dam was built by his grandfather during the mid-1890's. Mr. Sisco still resides within the Star Lake Camp property. He also reported the original purpose for the dam was to create a lake for a commercial ice house operation.

As described in paragraph 1.2a., an upstream dam failure during a storm in 1903 overtopped and washed out the right abutment of the original dam. The dam was repaired in 1904 by building the concrete section across the channel eroded by the 1903 flood.

Later post-construction rehabilitation was done in 1937, by John Sisco, to reduce leakage. The cast iron pipe siphon was installed at that time to drain the lake because the original slide gate outlet in the bottom of the masonry dam could not be opened. A new 12 inch diameter cast iron pipe and gate valve were installed inside the old diversion pipe.

No computations or drawings for the design and construction of the original or modified dam and spillway are available for review.

g. Normal Operational Procedures

The discharge from the lake is normally unregulated, however, the water level in the lake is very stable. The owner reported that the water level is lowered about 6 feet in the spring of each year to enable the cleaning of the swimming beach prior to the summer camping season. The water level allowed to return to its normal level each spring.

1.3 Pertinent Data

a. Drainage Area - 1.50 square miles.

b. Discharge at Damsite

Maximum known flood at damsite	N.A.
Warm water outlet at pool elevation	N.A.
Diversion tunnel low pool outlet at pool elevation	N.A.
Diversion tunnel outlet at pool elevation	N.A.
Gated spillway capacity at pool elevation	N.A.
Gated spillway capacity at maximum pool elevation	N.A.
Ungated spillway capacity at maximum pool elevation	335 cfs (El. 412.0)
Total spillway capacity at maximum pool elevation	335 cfs (El. 412.0)

c. Elevation (Feet above MSL)

Top of dam	412.0
Maximum pool-design surcharge	410.0

Full flood control pool	N.A.
Recreation pool	410.0
Spillway crest	410.0
Upstream portal invert diversion tunnel	N.A.
Downstream portal invert diversion tunnel	N.A.
Streambed at centerline of dam	397 ±
Maximum tailwater	N.A.

d. Reservoir

Length of maximum pool	1,160 ± feet (Estimate)
Length of recreation pool	1,160 ± feet (Estimate)
Length of flood control pool	N.A.

e. Storage (Acre-Feet)

Recreation pool	208 acre-feet (El. 410)
Flood control pool	N.A.
Design surcharge	224 acre-feet (El. 412)
Top of dam	224 acre-feet (El. 412)

f. Reservoir Surface (Acres)

Top of dam	7.88 ± acres (El. 412.0)
Maximum pool	7.88 ± acres (El. 412.0)
Flood control pool	N.A.
Recreation pool	7.88 acres (El. 410.0)
Spillway crest	7.88 acres (El. 410.0)

g. Dam

Type	Rock Faced Earthfill and Curved Concrete Gravity
Length	Approximately 300 feet
Height	14 feet
Top width	5 feet
Side slopes - Downstream	1-1/4 horizontal to 1 vertical
Zoning	Rock masonry retaining wall with earthfill and concrete gravity wall
Impervious core	Clay core (rock masonry section)
Cutoff	None
Grout curtain	None

h. Diversion and Regulating Tunnel (N.A.)

i. Spillway - (Both spillways)

Types	Overflow
Width of weirs - (Including upper and lower spillway portions)	47.5 feet (Rock masonry dam spillway with concrete cap) 52.2 feet (Concrete dam spillway)
Crest elevation	410 (Lower level elevation of rock masonry dam spillway)
Gates	None
Upstream channel	Cold Spring Lake
Downstream channel	15-20 feet wide, well defined channel with heavy rock slope protection

j. Regulating Outlets

Outlet #1	Size: N.A. (Inoperable)
Outlet #2	12 inch diameter (Operable)
Outlet #3	10 inch diameter (Inoperable)

SECTION 2: ENGINEERING DATA

2.1 Design

No drawings or computations pertaining to original construction, modification or repair of the dam could be found. No data from soil borings, soil tests or other geotechnical data is available. However, embankment and spillway sections, typical of the original dam, are included in the appendices. These sections illustrate the seepage pattern that develops and tabulates typical factors of safety for various ratios of wall thickness to height.

2.2 Construction

No records have been found as to the construction history of the dam. The history of the dam can be obtained orally from the penultimate owner, Mr. John Sisco.

2.3 Operation

No records of operation of the lake are kept by the owner. The only operating rule is to lower the lake each spring to enable cleaning swimming beaches for the coming summer camp activities. Otherwise,the lake is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

No engineering data was available for either the original section or the modifications and repairs to the dam.

b. Adequacy

While the engineering data was insufficient to perform a comprehensive, definitive evaluation of the dam's stability, an adequate assessment of the dam could be carried out with the data obtained in the field in view of the overall good condition of the dam.

c. Validity

Not applicable as no design or construction records were available.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection made of Cold Spring Lake Dam revealed that the dam and appurtenances were in serviceable condition, but a regular program of inspection and repair is required to maintain its serviceability.

b. Dam

The rock masonry retaining wall appears to be in good condition. No evidence of settlement or movement was apparent. The stones in the wall are of hard, durable rock and show no signs of deterioration. No stones were displaced from the wall.

The concrete gravity section shows some evidence of minor leakage through concrete cracks probably associated with cold joints formed during placement, but most areas showing signs of previous leakage are presently dry. The mass concrete exposed to view showed no signs of deterioration. There is a small amount of spalling occuring at the crest.

Gravel, sand and silt in low terrace deposits are exposed in road cuts east of the left abutment. It is believed this material extends to the left abutment and is the foundation for the dam. No outcrops were seen, however, the geology indicates that gneiss and amphibolite comprise bedrock under the alluvial deposits on the right and left abutment, respectively. Neither abutment shows evidence of sloughing or erosion except for a small amount of surface erosion due to roadway runoff on the left abutment a short distance downstream of the dam.

Seepage was observed flowing from beneath the apron at the base of the original section. Seepage was also observed immediately downstream of the concrete arch. In both locations the seepage appeared to be free of fine-grained soil (as well as coarse-grained soil). The seepage in the area of the concrete section was estimated at about 5 gpm. This seepage is believed to be occurring through the soil foundation under the section. No estimate of total seepage quantity could be made in the area of the original section due to discharge over the spillway. This seepage is believed to be occurring through both the embankment behind the wall and through the soil foundation under the dam.

c. Appurtenant Structures

1. Masonry Dam Spillway

A concrete cap was constructed over the original masonry dam spillway. The spillway is located in the right portion of the masonry section and is a broad-crested weir with free-fall discharge. The spill-

way has a lower central section for service discharges and a higher section on each side. The lower level spillway was discharging a small flow and was functioning very well. The crest of the weir is flat and extends over the full dam crest thickness. A small wooden footbridge was installed over the lower spillway notch. This bridge will probably be washed away if a large flow occurs over the upper level of the spillway. Erosion of backfill was observed behind the left wingwall of the spillway approach.

2. Concrete Spillway

Like the masonry dam spillway, this spillway is a broad-crested weir with free-fall discharge. The spillway is on the left side of the concrete section and has two levels. No water was discharging over any portion of the spillway. A permanent wooden footbridge was constructed across the crest, which would restrict the spillway discharge capacity during high flows and would tend to collect debris, which would further restrict flow. The concrete surfaces were slightly to moderately rough. The right wingwall of the spillway approach has settled, tilted and cracked.

3. Low-Level Outlet

The dam's low-level outlet is reported to be a 12-inch diameter cast iron pipe installed in the old outlet conduit. Both the inlet and outlet are submerged and could not be inspected. The control gate valve is reported to be operated annually for spring lowering of the lake, but is normally left in the closed position.

d. Reservoir Area

The slopes of the reservoir are gently sloping and exhibited no readily apparent signs of instability.

A geologic map of the lake and damsite is appended to the end of this report.

e. Downstream Channel

The discharge channel is well defined and about 15 to 20 feet wide. The side slopes are heavily riprapped and show no signs of erosion or sloughing. Two 81 inch by 48 inch concrete pipe culverts are located in a private access road immediately downstream of the dam. The total height between roadway and channel bottom is about 6 feet. A highway bridge lies further downstream with effective dimensions of about 12 feet by 3.5 feet for passing discharge from the dam. Total height between roadway and channel bottom is also about 6 feet.

3.2 Evaluation

At the time of the inspection neither the dam nor the abutment showed any signs of distress. The dam appears to be adequately maintained. The reservoir slopes are not believed to pose a threat to the safety of the dam. Downstream channel slopes appear to be in good condition.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Cold Spring Lake Dam is used to impound water for recreation activities. The policy is to maintain a nearly constant lake level close to the elevation of the spillway crest. The lake level is normally maintained by unregulated discharge over the notch in the spillway of the rock masonry section. The other spillway releases excess flow during storms.

The lake level is lowered early each spring by releasing water through the outlet pipe. The lake is usually lowered about 6 feet below the normal level during the cleaning and is allowed to refill naturally in the early spring.

4.2 Maintenance of the Dam

There is no program of regular inspection and maintenance of the dam and appurtenant structures. Operation and maintenance is done by the Star Lake Camp caretaker as a part of his duties. At present, no records of operation and maintenance are kept.

4.3 Maintenance of Operating Facilities

The low level outlet gate valve is opened annually for the spring lowering of the lake. No known maintenance of the valve has been made to keep the valve operable. The outlet pipe has not received maintenance.

4.4 Evaluation

Surveillance and maintenance is in the hands of the Star Lake Camp caretaker, Mr. Scott Fritz. A formalized program of periodic inspection by an experienced party should be initiated and documentation recorded to assist the owner.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Cold Spring Lake Dam is approximately 1.5 square miles. A drainage map of the watershed of Cold Spring Lake damsite is presented on Plate 1, Appendix D.

The topography within the basin varies from mountain type terrain in the northwest section to generally hilly in the southeast section. Elevations range from approximately 415 feet above mean sea level at the damsite to over 1,000 feet above mean sea level in the hills around Torne Mountain.

Land use patterns within the watershed are mostly urban with some forested lands in the hilly section of the basin. Most of the urban areas are located near the rim of the reservoir and in the lower elevation portion of the watershed.

The evaulation of the hydraulic and hydrologic features of Cold Spring Lake Dam was based on criteria set forth in the Corps guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation using Hydrometeorological Report No. 33 with standard reduction factors, and the 100-year flood was calculated from the 100-year precipitation using Weather

Bureau Technical Report No. 40. Due to the small drainage area of Cold Spring Lake Dam, the SCS triangular hydrograph, transformed to a curvilinear hydrograph, was adopted for developing the unit hydrograph. The derived unit hydrograph is presented in Appendix D.

Initial and infiltration loss rates were applied using SCS procedure to the Probable Maximum Storm rainfall and the 100-year rainfall to obtain rainfall excesses. The rainfall excesses were then applied to the unit hydrograph to obtain the PMF and the 100-year flood hydrographs utilizing program HEC-1.

The computed peak discharges of one-half the PMF and the 100-year flood are 3,726 cfs and 2,832 cfs, respectively.

Both one-half the PMF and the 100-year flood inflow hydrographs were routed through the reservoir by the Modified Puls Method, also utilizing computer program HEC-1. The peak outflow discharges for one-half the PMF and the 100-year flood result in overtopping of the dam.

The stage-outflow relation for the spillway was prepared from field notes and sketches. The reservoir stage-capacity data were based on the U.S.G.S. quadrangle topographic maps in combination with data given in the National Dam Safety Inventory Table. Reservoir storage capacity included surcharge levels exceeding the top of the dam and the spillway rating curve assumed that the dam remains intact during routing. In the routing computations, the discharge through outlet facilities was excluded due to its insignificant magnitude as compared to the spillway discharge and one-half the PMF. The spillway rating curve and the reservoir capacity

curve are presented in Plates 2 and 3 of Appendix D, respectively.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to interviews with local residents, the maximum reservoir level was never higher than the dam crest.

c. Visual Observations

The spillway structure is well maintained and the approach channel is well defined, but heavy sedimentation deposits and vegetative growth were observed in the reservoir on the upstream side of the spillway crest. No new urbanization was noted in the reservoir area. The downstream channel is also well defined with moderate riprap along the river banks.

d. Overtopping Potential

As indicated in Section 5.1-a., both one-half the Probable Maximum Flood and the 100-year flood, when routed through Cold Spring Lake Reservoir, result in overtopping the dam. The spillway and reservoir surcharge capacities are too small to accommodate the peak flows. One-half the PMF and the 100-year flood overtopped the dam by 2.2 feet and 1.7 feet, respectively. The spillway is only capable of passing a flood roughly equal to ten percent of one-half the PMF without overtopping the dam. Since the 100-year flood is the minimum Spillway Design Flood (SDF) for this dam, according to the <u>Recommended Guidelines for Safety Inspection of Dams</u> by the Corps of Engineers, the spillway capacity of the Cold Spring Lake Dam is considered "Inadequate".

e. Reservoir Drawdown

The reservoir drawdown below the spillway crest, elevation 410, is accomplished by permitting discharge through the 12-inch cast iron pipe with assumed entrance and exit inverts at elevation 399. The minimum tailwater corresponds to the top of the conduit, elevation 400, resulting in a total head differential of 10 feet. Assuming a constant inflow of 3 cfs (2 cfs/sq. mi.), the total drawdown time is 28 days, at which point the inflow equals the outflow and the reservoir pool is at elevation 401 feet. Assuming zero inflow, the drawdown to elevation 401.04 can be accomplished in 12-1/2 days.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam did not exhibit any visible signs of distress. The masonry wall in the original section did not exhibit any leaning or bulging and no stones were displaced. No structural cracking was observed in the concrete arch section. Based on a visual inspection and in view of past performance, the structure appears to be stable.

b. Design and Construction Data

No design or construction data were available.

c. Operating Records

No operating records were available.

d. Post Construction Changes

As discussed in Section 1.2, the only post construction change made was the construction of a concrete arch section in 1904 as a result of damage to the right abutment in 1903.

e. Static Stability

1. Rock Masonry and Earthfill Section

Dimensions of the embankment, wall, spillway and the level of the water behind the dam, along with observations regarding the drainage characteristics of the wall, define the boundary conditions for the flow of water through the dam. The seepage pattern will change with the position of these boundaries but will generally conform to the pattern illustrated on the figures presented in the appendices. Inspection of the masonry wall and the soil behind it allow reasonable assumptions pertinent to the stability analysis to be made.

Stability calculations were performed using the Trial Wedge Method and assumed soil parameters. Safety factors were determined against overtopping and sliding for different ratios of wall thickness to height. The results are presented in Appendix E.

The results of this analysis establish that the embankment wall and spillway are stable under the force exerted by the soil behind them for a wall thickness (W) to height (H) ratio greater than or equal to 0.2. Even during overtopping the walls were found to be stable against sliding and overturning. Overtopping of the embankment wall would yield a factor of safety equal to that of the spillway.

2. Concrete Gravity Dam Section

The total shape and dimensions of the concrete section, especially under the upstream earthfill, will profoundly affect its stability. Also, the depth to the base of concrete, along with the nature and strength parameters of the foundation will influence the stability of the section. None of this information is presently available. Therefore, it is not possible to make a definitive statement on the stability of the concrete section.

However, the concrete gravity section has remained intact over it's 74 year life since it was constructed in 1904. Further, no evidence was apparent of settlement, misalignment, cracks, foundation heaving or other indications of instability.

It should be emphasized that these analyses function only as an aid in assessing the structural adequacy of the dam. The reliability of the results are a function of the assumptions made in the analysis. No data was available on the strength parameters of the masonry or embankment and no cross sections of the dam were available.

f. Seismic Stability

A north-south trending fault, mapped by others, occurs about 750 feet east of the dam. The dam is located in Seismic Zone 1, as defined in Recommended Guidelines For Safety Inspection of Dams as prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake,

provided the static stability conditions are satisfactory and conventional safety margins exist.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for Phase I Reports.

The safety of Cold Spring Lake Dam is in question because the dam does not have adequate spillway capacity to pass one-half of the PMF or even the 100-year flood without overtopping. Overtopping of the dam carries with it the danger of possible progressive failure of the abutments of the dam. The dam's present spillway capacity can pass only about ten percent of one-half the PMF.

No definitive statement pertaining to the safety of the dam can be made without acquisition of embankment and foundation material engineering properties and determination of the true cross sectional dimensions of the dam. The present dam, however, has performed adequately since the 1904 modification without failure or evidence of instability. It should be emphasized that the safety of this dam can be threatened by failure of any one of several upstream lakes which include the Upper and Lower Star Lakes and Kampfe Lake.

b. Adequacy of Information

The information and data uncovered is not adequate to perform a comprehensive, definitive evaluation of the dam's stability. Nevertheless, in view of the past performance of the dam, its present condition, and in light of the stability calculations performed, it is not felt that additional information on the engineering properties of the embankment and foundation materials is necessary at this time. Nevertheless, it is believed desirable to have a survey of the dam made to determine and prepare drawings of the true shape and dimensions of the dam structures. The seepage at the toe of the downstream embankment, however, does call for regular observations and measurement to detect any changes in quantity or clarity of seepage water.

c. Urgency

Studies to augment the spillway discharge capacity should be undertaken within six months, and a plan formulation should be completed within a 12-month period.

The program for regularly observing seepage should be implemented within six months.

The as-built set of dam plans and drawings should be completed within a 6 month period.

7.2 Remedial Measures

a. Alternatives

The alternatives available for increasing the spillway capacity are:

1. Increasing the dam height, thus permitting a higher discharge to pass over the spillway without overtopping.

2. Providing for auxiliary spillway on the right abutment by "hardening" the top of the abutment and re-entry path to the downstream brook channel sufficiently to withstand emergency flows of one-half PMF magnitude.

3. A combination of the above alternatives.

7.3 Recommendations

Based on the visual inspection and data evaluation presented herein, the following action is recommended.

1. A program should be developed to monitor the seepage through and under the dam. Depending on the information provided, the need for corrective measures can be considered and, if necessary, undertaken.

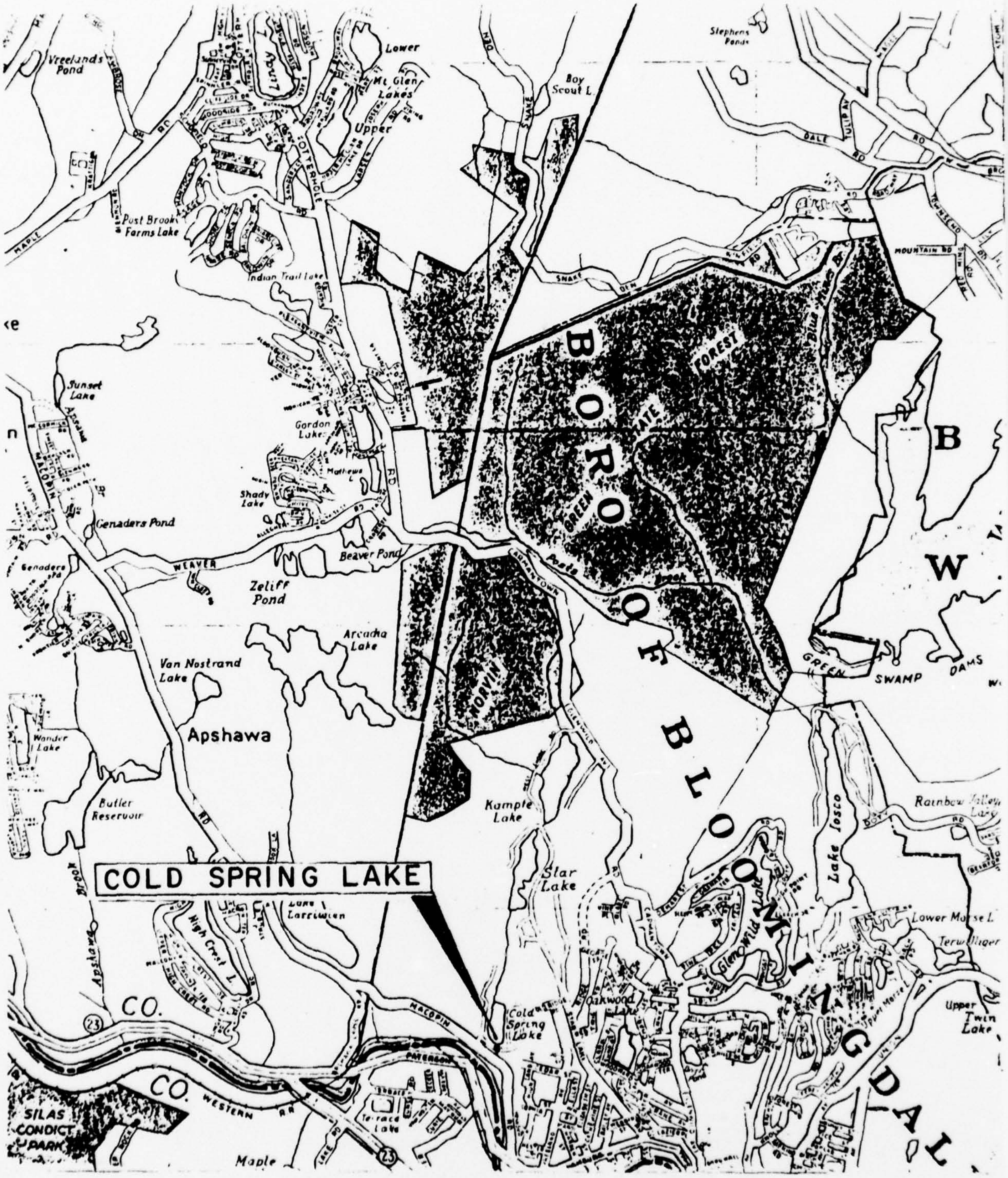
2. The downstream waterway below the concrete spillway should be cleared of brush and debris. The channel should be protected by rock riprap.

3. No additional mortar should be added to the face of the masonry dam. Sealing the wall will alter the free draining characteristics of the wall and could allow for a build up in hydrostatic pressure at the back of the wall.

4. All walkways and handrails on the dam should be removed, as they can start a debris backup, increasing the head on the dam.

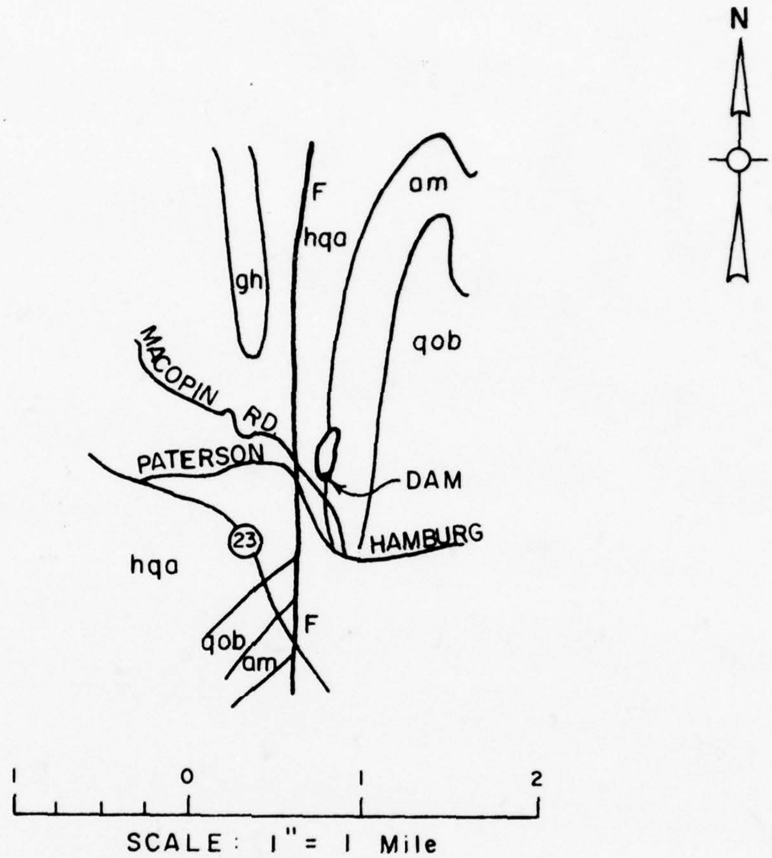
5. The owner should initiate a program of annual inspections of the dam utilizing the standard visual check list in this report. Headwater and tailwater gages should be installed in the dam and read out during severe rainstorms and at routine operating and maintenance visits to the dam. A permanent log should be kept of all maintenance and operating events of the dam, the lake and the outlet passages.

PLATES



VICINITY MAP

PLATE 1



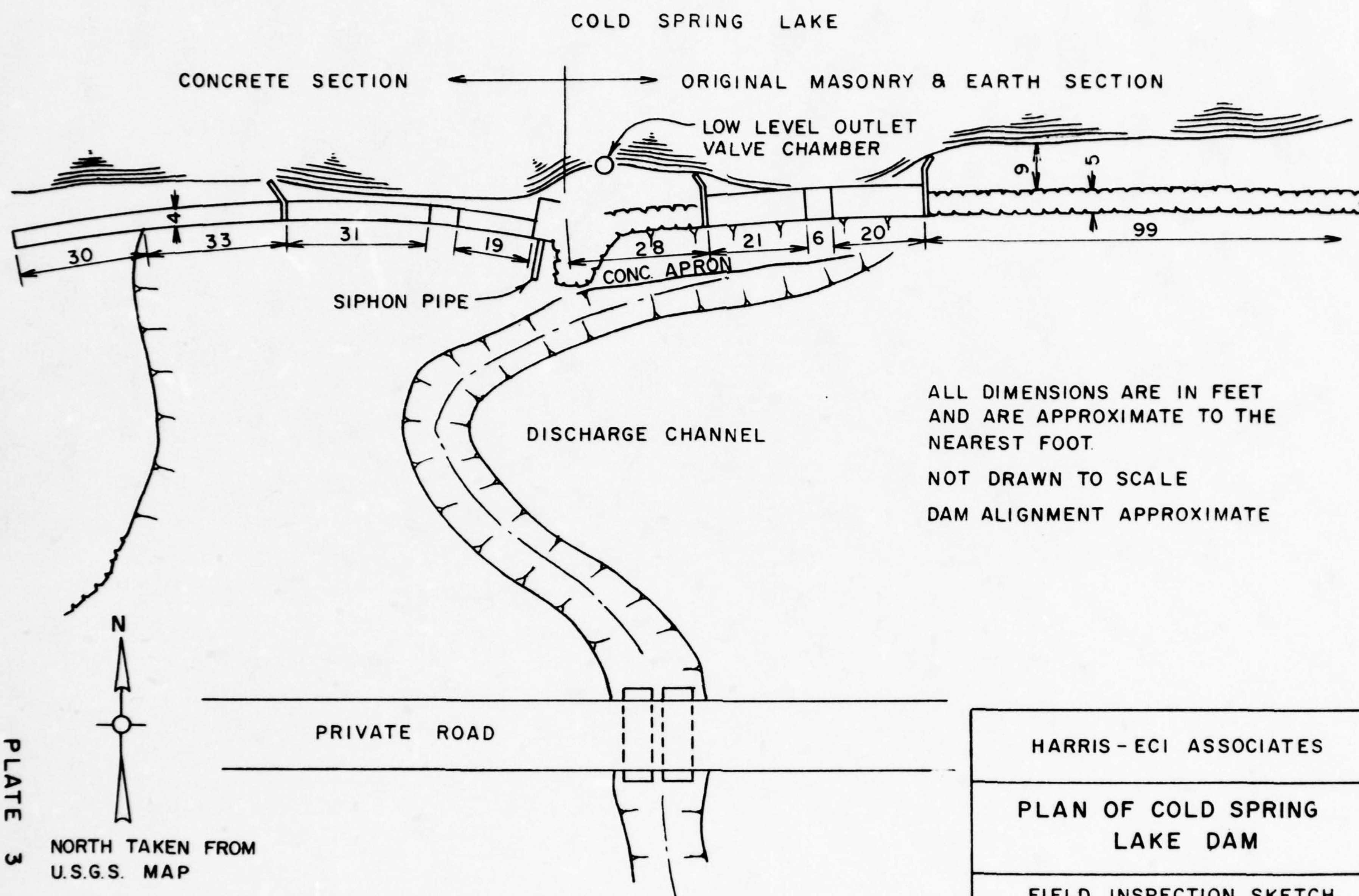
LEGEND

gh	MOSTLY HORNBLENDE GRANITE AND GNEISS
hqa	HYPSTHENE - QUARTZ - ANDESINE GNEISS
am	AMPHIBOLITE
qob	QUARTZ - OLIGOCLASE - BIOTITE GNEISS
F	FAULT

NOTE: BEDROCK IS MANTLED BY GRAVEL, SAND AND SILT IN LOW-LEVEL TERRACE DEPOSITS.

GEOLOGIC MAP
COLD SPRING DAM

PLATE 2



HARRIS-ECI ASSOCIATES		
PLAN OF COLD SPRING LAKE DAM		
FIELD INSPECTION SKETCH		
D.J.K.	8-1-78	1 OF 1

PLATE 3

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST

Visual Inspection
Phase I

Name Dam Cold Spring Lake County Passaic State New Jersey Coordinators ____________

Date(s) Inspection June 27, 1978 / June 28, 1978 Weather Clear-Warm Temperature $80^{\circ}F$

Pool Elevation at Time of Inspection No Gage M.S.L. Tailwater at Time of Inspection No Gage M.S.L.

Inspection Personnel:

(June 27 & 28, 1978)	(July 7, 1978)	(July 7, 1978)
Joe Sirianni	Yin Au-Yeung	Wm. Flynn
Henry King	Lynn Brown	
David Kerkes		

Robert B. Campbell Recorder

Owner Representative:

(June 27, 1978)	(June 28, 1978)	(June 28, 1978)
Scott Fritz, Caretaker Star Lake Camp Salvation Army	Major T. Adams General Secretary for Business and Properties Salvation Army New York, New York	Mr. John Sisco, Previous Owner Star Lake Camp Salvation Army

CONCRETE/MASONRY DAMS

Type - Curved Concrete Gravity Dam

Cold Spring Lake

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	Minor leaks through horizontal "cold joints" in concrete. Seepage all along the toe. Total seepage estimated to be 2 to 5 gpm.	Suggest installation of the seepage collection and measuring system to enable monthly observation of seepage flow to detect changes in quantity or clarity of water.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Right abutment appears satisfactory without evidence of seepage or erosion. Left abutment consists of rock masonry buttress integral with rock masonry dam. Buttress appears sound with no evidence of significant seepage.	
DRAINS	Numerous small (1-1/2") iron pipes projecting from downstream face of dam, very heavily rusted, but no seepage coming from pipes. Pipes reported (by previous owner, John Sisco) to be grout pipes drilled and installed into concrete dam to stop leakage through joints after initial construction.	Pipes should be cut off at face of concrete and holes should be plugged with grout.
WATER PASSAGES	See Outlet Works.	
FOUNDATION	Appears to be earth foundation. No evidence of foundation problems were found.	

CONCRETE/MASONRY DAMS

Type - Curved Concrete Gravity Section

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Top of concrete moderately rough with some surface spalling. Downstream face intact with no spalls. Dam crest is also pedestrian walkway.	Spalled areas should be cleaned and repaired.
STRUCTURAL CRACKING	Two vertical cracks show some leaching but are dry.	Annual inspection of dam should be made to detect new or renewed seepages.
VERTICAL AND HORIZONTAL ALIGNMENT	No evidence of movement of the dam section can be found.	
MONOLITH JOINTS	Tight with no leakage evident.	
CONSTRUCTION JOINTS	Vertical construction joints are dry. No horiziontal construction joints can be identified except below 6-inch thick cap slab. Some leaching evidence visible there.	

EMBANKMENT

Cold Spring Lake

Type - Stone Masonry and Earth Embankment

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No evidence of surface cracks found. Downstream face formed by rock masonry wall on about 1/4:1 slope with 5′ wide crest mortared over, and 9′ earth behind wall at crest. Concrete cap over spillway. Downstream face mortared over left and right of spillway.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No surficial evidence of movement or cracking at or beyond toe.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No evidence of upstream sloughing or erosion. Minor erosion of left abutment slope about 15 feet downstream of masonry face caused by runoff from camp road.	Regrade slope and road shoulder and protect with vegetative cover.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No evidence of movement found.	
RIPRAP FAILURES	No riprap.	

EMBANKMENT

<u>Cold Spring Lake</u>

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junction to left abutment and to concrete dam section on right abutment appear sound and are dry.	
ANY NOTICEABLE SEEPAGE	Much seepage from base of masonry walls is evident. Seepage flows from holes in grouted rubble apron at base of wall and probably is coming from all along the toe of the wall.	Inspect seepage monthly to detect any unusual increase in quantity in clarity of flow.
STAFF AND GAGE RECORDER	None.	
DRAINS	None can be found.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Low level outlet is 12 inch C.I. pipe. There is also a 12" C.I. siphon pipe (exposed through downstream face of dam) and extends downstream and across Macopin Road. Siphon has been abandoned for about 10 years.	
INTAKE STRUCTURE	Submerged and not visible. Cannot be inspected. Reported to be C.I. pipe laying on lake bottom with screen over inlet.	
OUTLET STRUCTURE	None. Low level outlet has submerged discharge into spillway discharge channel. Siphon pipe discharge has been buried and lost.	
OUTLET CHANNEL	Same as spillway.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

#1 - Rock Masonry Section

Cold Spring Lake

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Broad crested wier, 2-level overflow. Concrete surface moderately rough with minor frost spalls. Minor erosion of backfill behind left upstream wingwall of spillway.	Backfill behind wingwall.
APPROACH CHANNEL	None - Full reservoir approach but bottom very shallow in front of spillway.	
DISCHARGE CHANNEL	Channel lined with grouted rubble in front of masonry section. Discharge turns immediately to right and grouted rubble extends about 75 feet along centerline of flow, then turns left downstream of concrete dam section. Downstream channel is lined with heavy rock riprap.	
BRIDGE AND PIERS	Wooden footbridge across service spillway. Probably will be washed away with large flow across upper wier.	

Cold Spring Lake

UNGATED SPILLWAY

#2 - Concrete Dam Section

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Broad crest wier, 2-level overflow. Concrete surface slightly to moderately rough. No projection for waterfall.	
APPROACH CHANNEL	None - Full reservoir approach but bottom very shallow and slopes gently away.	
DISCHARGE CHANNEL	Channel immediately in front of dam very heavily overgrown with vines. Downstream channel lined with medium to large boulders. No debris or obstructions in channel.	Remove brush and vines from channel.
BRIDGE AND PIERS	Wooden footbridge on concrete piers.	

Cold Spring Lake

GATED SPILLWAY

(None)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N.A.	
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	N.A.	
BRIDGE AND PIERS	N.A.	
GATES AND OPERATION EQUIPMENT	N.A.	

INSTRUMENTATION

Cold Spring Lake

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

RESERVOIR

Cold Spring Lake

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Slopes mostly gently sloping away from lake. None appear unstable.	
SEDIMENTATION	Upper and Lower Star Lakes and Kafee Lakes all a short distance upstream. No apparent sediment problems.	
SHORELINE STRUCTURES	No buildings on or near shorelines. Boat and swimming piers on shoreline.	
USE	Recreation (swimming and boating) in conjunction with Salvation Army Summer Camp activities.	
OPERATION	Lake level held constant year round except for about one week in the spring for beach cleaning purposes.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Channel is trapezoidal shape with 15-20 feet wide bottom. Two 81" x 48" squash culvert road crossing within camp property approximately 250 feet downstream. Small bridge 12 feet long by 3-1/2 feet deep (6 feet roadway to channel bottom) from Macopin Road about 400 feet downstream. Channel is clean with no debris.	
SLOPES	Channel sideslopes 1-1/2 to 1 with heavy boulder protection.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	No dwellings exist between the dam and the confluence with Pequanick River. Abandoned industrial building across Macopin Road and near channel.	

CHECK LIST
ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION

Cold Spring Lake Dam

ITEM	REMARKS
PLAN OF DAM	None available.
REGIONAL VICINITY MAP	Available.
CONSTRUCTION HISTORY	Original construction history and post construction history is available orally from Mr. John Sisco, previous owner and grandson of original builder.
TYPICAL SECTIONS OF DAM	None available.
HYDROLOGIC/HYDRAULIC DATA	None available.
OUTLETS - PLAN	)
- DETAILS	) None Available.
- CONSTRAINTS	)
- DISCHARGE RATINGS	)
RAINFALL/RESERVOIR RECORDS	None Available.

CHECK LIST
ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION
(Continued)

Cold Spring Lake Dam

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Unknown.
SPILLWAY - PLAN - SECTIONS - DETAILS	None available.

CHECK LIST
ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION
(Continued)

Cold Spring Lake Dam

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	) None available.)
MONITORING SYSTEMS	None available.
MODIFICATIONS	Concrete gravity section built in 1904. Clay core added and new outlet pipe installed in 1937.
HIGH POOL RECORDS	None available.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OR FAILURE OF DAM - DESCRIPTION - REPORTS	A severe storm in 1903 overtopped and washed out a large section of the right abutment.
MAINTENANCE, OPERATION RECORDS	None available.

APPENDIX B

PHOTOGRAPHS

All photos were taken on June 27 & 28, 1978.

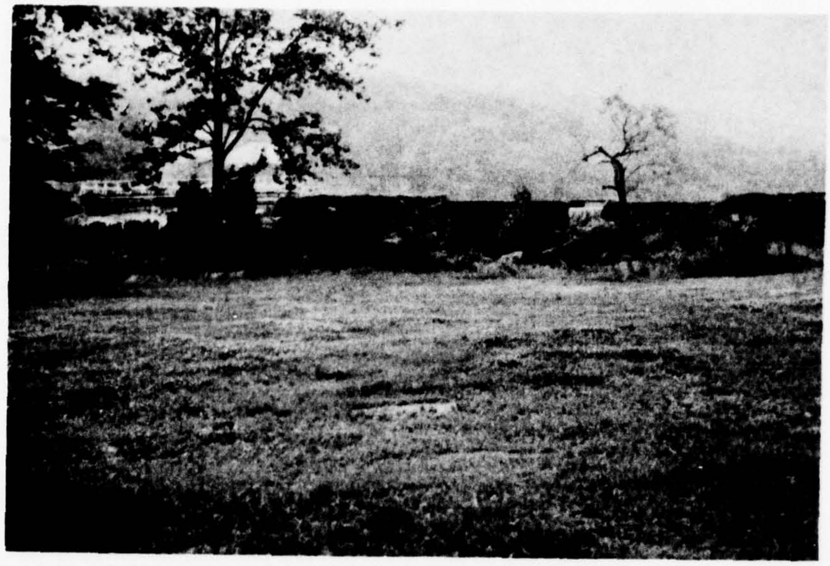


Photo 1 - Overall view of dam.

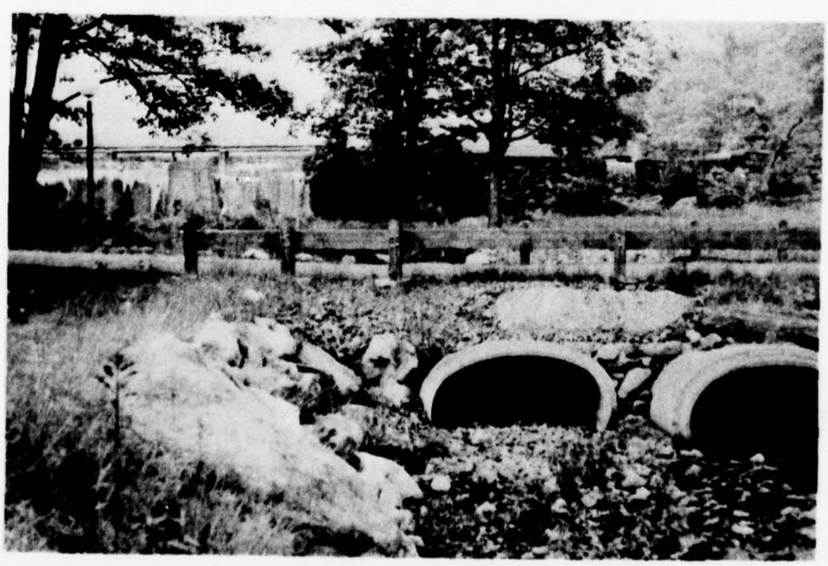


Photo 2 - Overall view of dam and culverts in discharge channel under private road.

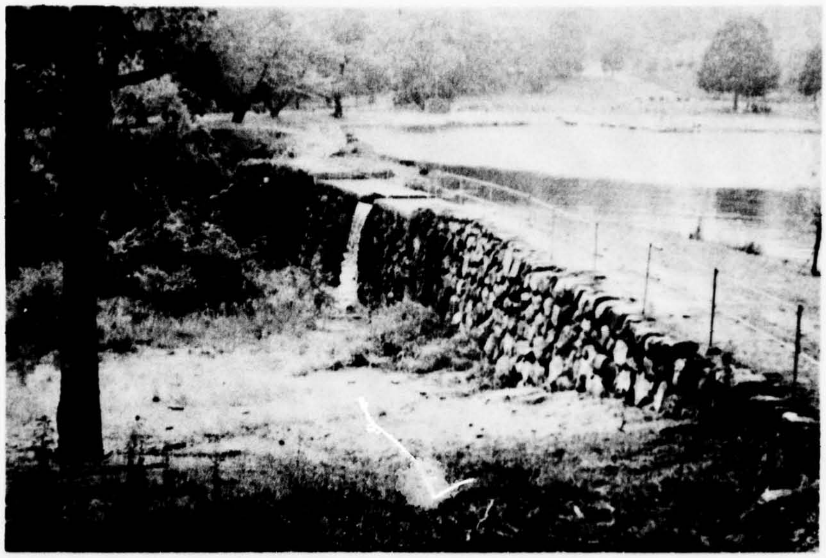


Photo 3 - View of dam from left abutment showing original rock masonry dam.

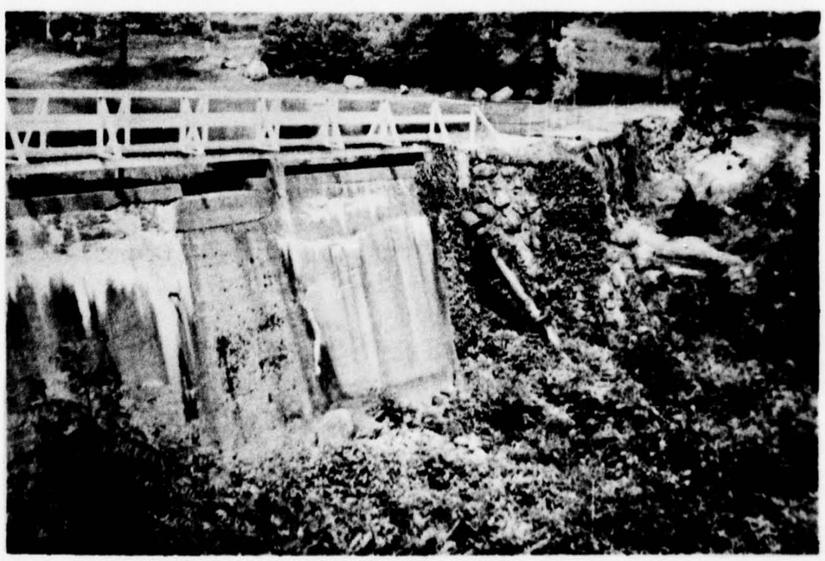


Photo 4 - View of dam from right abutment showing added concrete dam, spillway and abandoned cast iron pipe siphon.

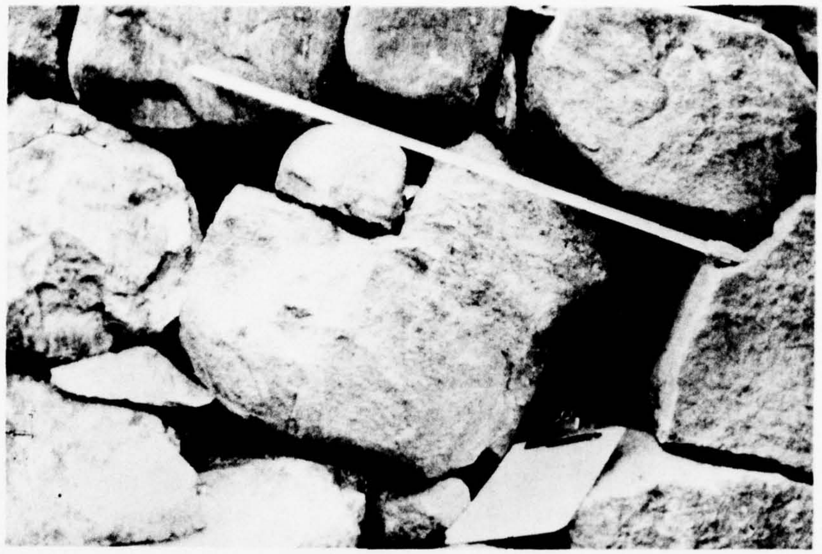


Photo 5 - Rock wall masonry of original dam.

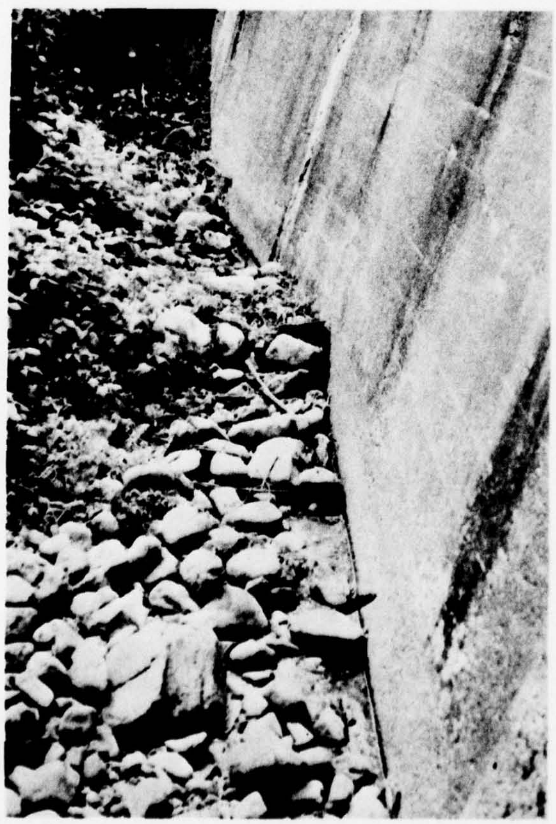


Photo 6 - Seepage at base under spillway of concrete dam.

Photo 7 - Spillway in masonry dam.

Photo 8 - View of spillway in concrete dam showing channel under spillway heavily covered with brush and vines. Discharge channel from masonry dam in foreground.

Photo 9 - Outlet valve chambers and footbridge over concrete dam spillway.

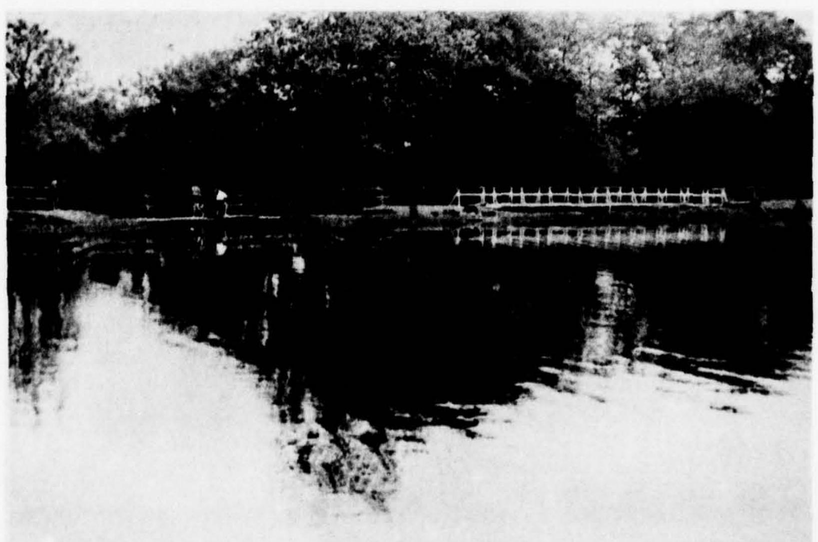


Photo 10 - View of spillways from upstream left shoreline.

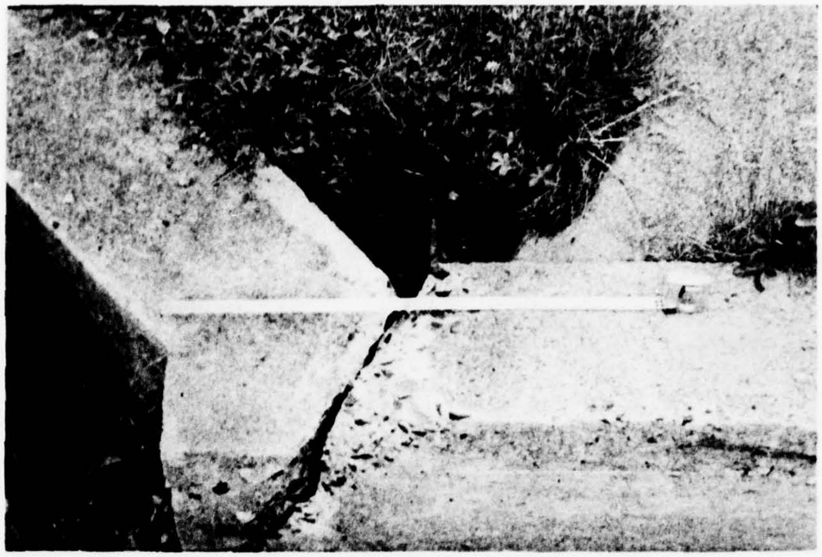


Photo 11 - Erosion and settlement of wingwall at left side of approach to masonry spillway.

Photo 12 - Drainage channel for masonry spillway.

Photo 13 - Downstream drainage channel, private road, culverts and highway bridge in background.

Photo 14 - Highway bridge under Macopin Road downstream of dam.

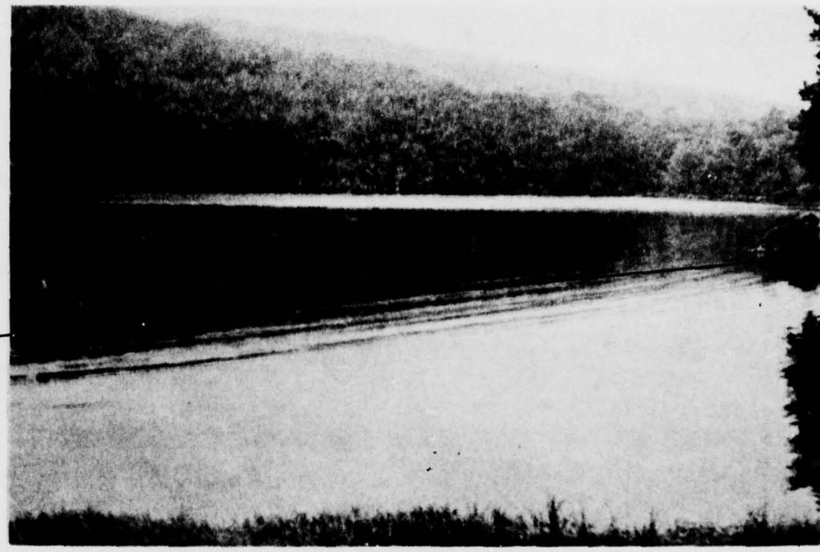


Photo 15 - View of Cold Springs Lake from near right abutment.

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

Name of Dam: Cold Spring Lake Dam

Drainage Area: 1.5 square miles

Elevation Top Normal Pool (Storage Capacity): 410 (208 AF)

Elevation Top Flood Control Pool (Storage Capacity): N.A.

Elevation Maximum Design Pool: 412

Elevation Top of Dam: 412

SPILLWAY CREST:

a. Elevation: 410 (Rock Masonry Dam Spillway)

b. Type: Overflow (Both Spillways)

c. Width: 4 foot (Concrete Spillway) 7 foot (Masonry Spillway)

d. Combined Length: 99.7 feet

e. Location Spillover: Middle and left part of the dam

f. Number and Type of Gates: None

OUTLET WORKS: (Outlet #2)

a. Type: 12-inch diameter conduit

b. Location: Base of the dam near the concrete spillway

c. Entrance Inverts: N.A.

d. Exit Inverts: N.A.

e. Emergency Draindown Facilities: Flow through outlet is controlled by 12-inch diameter gate valve

HYDROMETEOROLOGICAL GAGES: (N.A.)

a. Type: ________

b. Location: ________

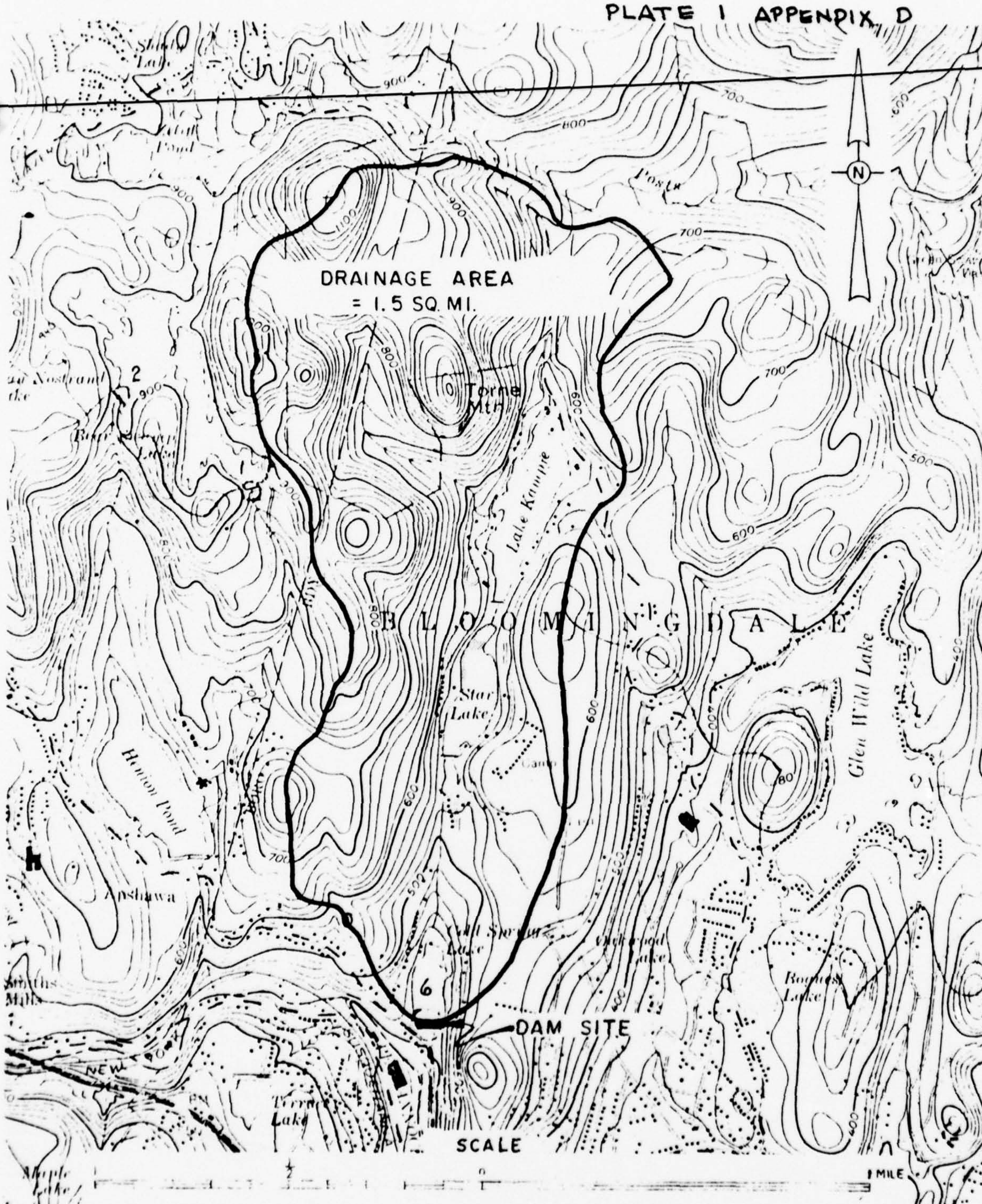
c. Records: ________

MAXIMUM NON-DAMAGING DISCHARGE: 335 cfs (Estimated)

APPENDIX D

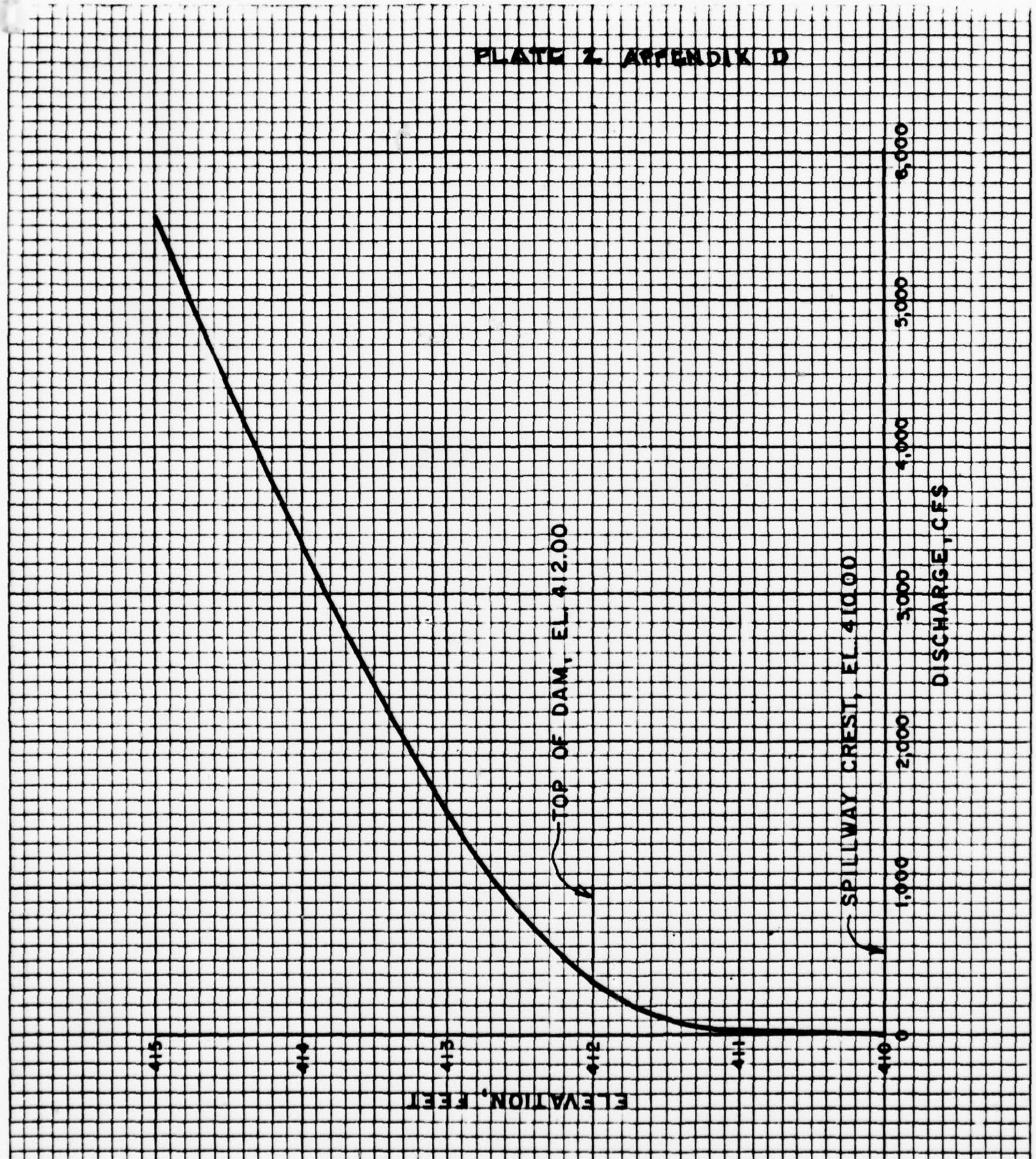
HYDROLOGIC COMPUTATIONS

PLATE 1 APPENDIX D



COLD SPRING LAKE DAM
DRAINAGE BASIN

PLATE 2 APPENDIX D



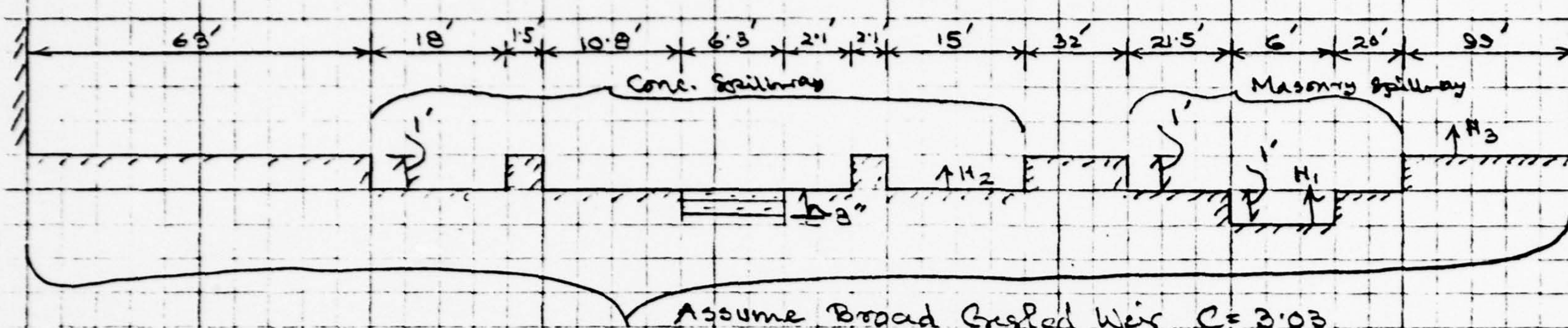
COLD SPRING LAKE DAM
SPILLWAY & OVERTOP RATING CURVE

NEW JERSEY (STATE) DAM SAFETY INSPECTION — SHEET NO. 1 OF ___

COLD SPRING LAKE DAM — JOB NO. 1212-09

SPILLWAY & OVERTOP RATING CURVE — BY LMAS — DATE 7-17-

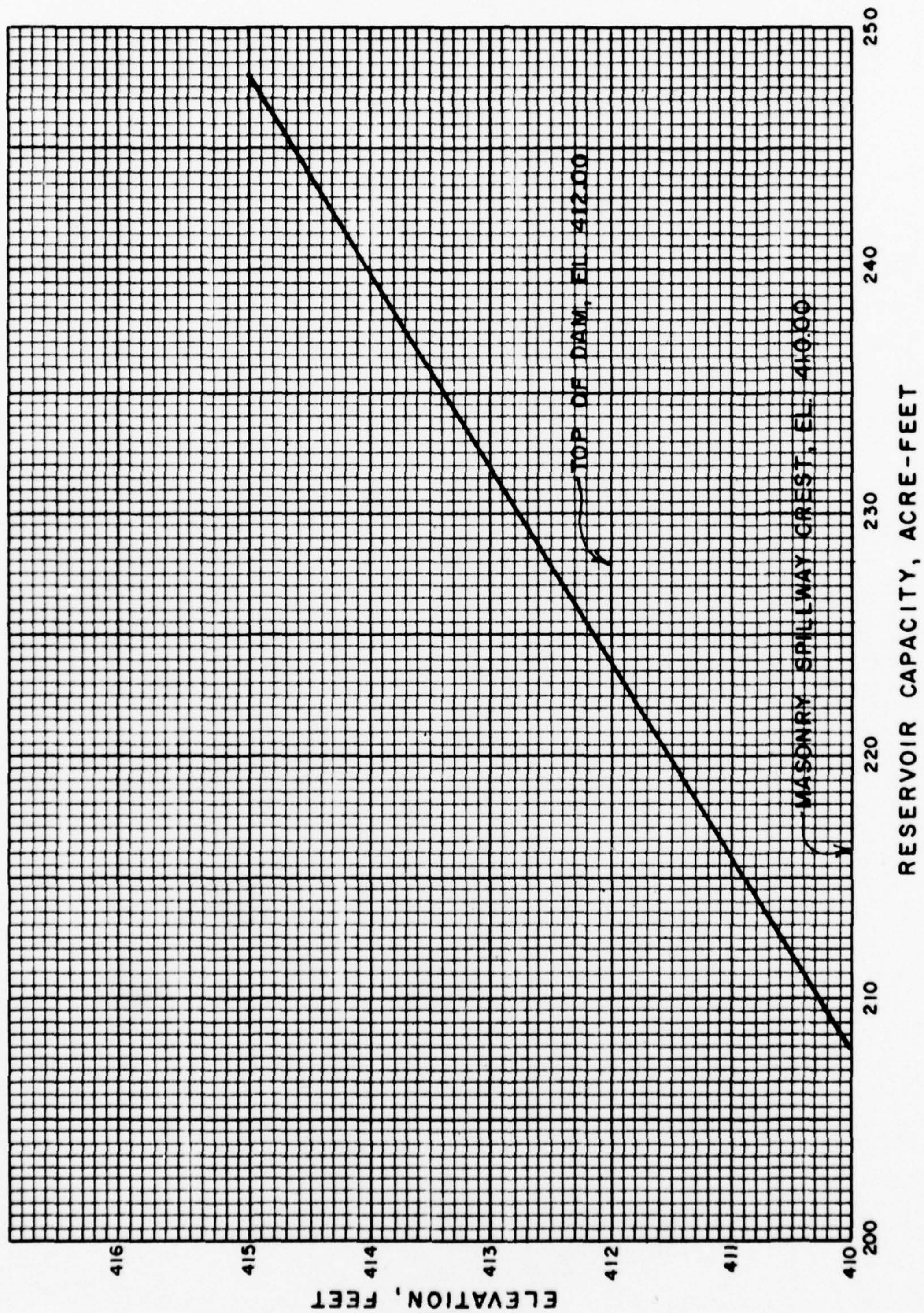
$L_1 = 6'$, $L_2 = 18+10.8+6.3+2.1+15+21.5+20 = 93.7$, $L_3 = 63+1.5+21+32+99 = 197.60$



Assume Broad Crested Weir, C= 3.03
Assume Stoplogs in Place
Assume Elevation of Masonry Spillway Weir Crest to be 410 (MSL)

ELEV. MSL (Assumed) Feet	Head on Masonry Spillway Weir Crest, Ft	H_1	H_2	H_3	L_1	L_2	L_3	C_1	C_2	C_3	$Q = \sum_{i=1}^{3} C_i L_i H_i^{1.5}$
410	0	0	0	0							0
411	1	1	0	0	6'			3.03			18
412	2	2	1	0	6'	93.7		3.03	3.03		335
413	3	3	2	1	6'	93.7	197.6	3.03	3.03	3.03	1496
414	4	4	3	2	6'	93.7	197.6	3.03	3.03	3.03	3313
415	5	5	4	3	6'	93.7	197.6	3.03	3.03	3.03	5585

PLATE 3 APPENDIX D



COLD SPRING LAKE DAM
RESERVOIR CAPACITY CURVE

ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 1 OF

COLD SPRING LAKE DAM JOB NO. 1212-001

RESERVOIR AREA CAPACITY DATA BY MAS DATE 6-17-

COLD SPRING LAKE DAM

RESERVOIR AREA CAPACITY DATA

Maximum Storage = 208 AC-FT

Normal Storage = 208 AC-FT

Reservoir Surface Area = 7.88 Acres (USGS 7 1/2 topo map) at an elevation of ≃ 410

Assumed Elevation (MSL) ft	Head on Masonry Spillway Crest Ft	Reservoir Area Acres	Reservoir Volume AC-FT	Remarks
410.0±	0	7.88±	208	The normal & maximum storage of 208 A-F is assumed to be masonry spillway crest. The spillway crest elevation is assumed to be 410± MSL
412.0	2	8±	224	The Reservoir volume is computed by assuming the same area of 8± Acres
415	5	8±	248	

UNIT HYDROGRAPH - COLD SPRING LAKE DAM

a) Drainage Area = 1.5 Sq. mi.

b) L = 1.42 miles (from page 2)

c) T_c = 0.36 hrs (from page 2)

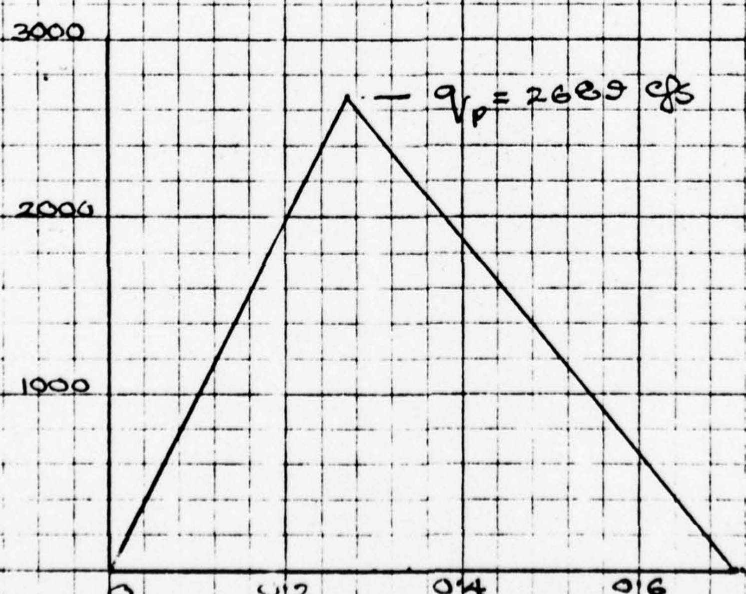
d) Assume $D = 0.10 < \frac{T_c}{2}$

e) $T_p = \frac{D}{2} + 0.6 T_c = 0.05 + 0.6 \times 0.36$

$= 0.27$ hrs

f) $T_b = 2.67\, T_p = 0.71$ hrs

g) q_p cfs $= \frac{484 A \text{ (sq. mi)}}{T_p \text{ (hrs)}} = \frac{484 \times 1.5}{0.27} = 2689$ cfs



ECI-4 **ENGINEERING CONSULTANTS, INC.**

NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 2 OF

COLD SPRING LAKE DAM #6 JOB NO. 1212-001

DETERMINE BASIN PARAMETERS BY KLB DATE

DETERMINE LENGTH OF STREAM

FROM U.S.G.S. QUAD MAP

$$L = 3.75'' \times \frac{24000}{12 \times 5280} = \underline{1.42} \text{ MILES} = \underline{7500 \text{ ft}}$$

DETERMINE BASIN SLOPE

$$\Delta H = 910 - 415 = 495 \text{ FT.}$$

DETERMINE TIME OF CONCENTRATION

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 \times 1.42^3}{495}\right)^{0.385}$$

$$= 0.36 \text{ HRS}$$

ECI-4 **ENGINEERING CONSULTANTS, INC.**

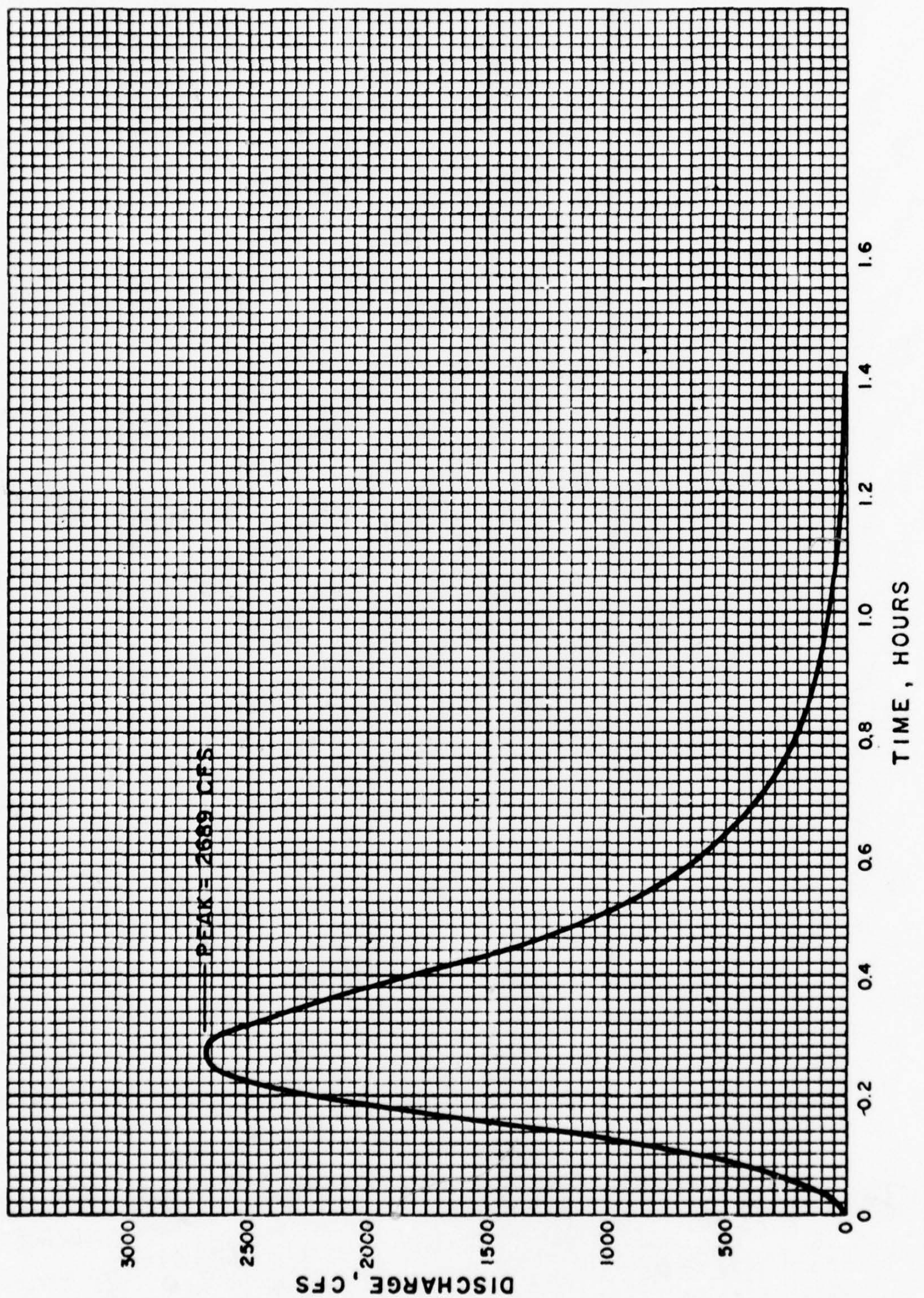
NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 3 OF

COLD SPRING LAKE DAM #6 JOB NO. 1212-001

UNIT HYDROGRAPH BY MAD DATE 7-11-7

B) Curvilinear Unit Hydrograph

Time Ratio T/T_p	Discharge Ratio q/q_p	UNIT GRAPH: Time T hrs	UNIT GRAPH: Discharge q cfs
0	0	0	0
0.1	0.015	0.027	40
0.2	0.075	0.054	202
0.3	0.16	0.081	430
0.4	0.28	0.11	753
0.5	0.43	0.14	1156
0.6	0.60	0.16	1613
0.7	0.77	0.19	2071
0.8	0.89	0.22	2393
0.9	0.97	0.24	2608
1.0	1.00	0.27	2689
1.1	0.98	0.30	2635
1.2	0.92	0.32	2474
1.3	0.84	0.35	2259
1.4	0.75	0.38	2017
1.5	0.66	0.41	1775
1.6	0.56	0.43	1506
1.8	0.42	0.49	1129
2.0	0.32	0.54	860
2.2	0.24	0.59	645
2.4	0.18	0.65	484
2.6	0.13	0.70	350
2.8	0.098	0.76	264
3.0	0.075	0.81	202
3.5	0.036	0.95	97
4.0	0.018	1.08	48
4.5	0.009	1.22	24
5.0	0.004	1.35	11



COLD SPRING LAKE DAM
0.10 HR. UNIT HYDROGRAPH

New Jersey Dam Safety Inspection — SHEET NO. ___ OF ___

PMF Derivation Cold Spring Lake Dam — JOB NO. ___

Probable Maximum Precipitation — BY YIN — DATE July 1978

PROBABLE MAXIMUM FLOOD CALCULATION (PMF)

DRAINAGE = 1.50 sq. mi

From "Hydrometeorological Report #33 Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Duration of 6, 12, 24 and 48 Hours" 1956

For D.A. = 10 sq. mi.

6 hour rainfall duration

PMP = 25.0" for Zone 6 at Basin.

Since D.A. < 10 sq mi, No area reduction to be applied.

PMP Values for varies rainfall duration

Duration	PMP (inch)	
6 Hr	1 ×	= 25.0"
12 Hr	1.09 ×	= 27.25
24 Hr	1.17 ×	= 29.25
48 Hr	1.26 ×	= 31.50

PMP values are reduced by 20% to account for misaligment of Basin and Storm Isohyetals

Duration	PMP
6 Hr	20.0"
12 Hr	21.8 "
24 Hr	23.4 "
48 Hr	25.2 "

Can be neglected.

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY DAM SAFETY INSPECTION (DEP) — SHEET NO. ____ OF ____
PMF DERIVATION - CONT'D — JOB NO. 1212
PROBABLE MAXIMUM PRECIPITATION — BY YIN — DATE ____

1.50 SQ. mi.

PMP. PMF DERIVATION.

1) SOIL GROUP "C", & AMC = II.

2). CN = 85.

MIN LOSS RATE FOR ABOVE CONDITION IS 0.12"/hr.

or 0.04"/⅓ hr.

FOR CN = 85,

S = 1.76 in the

Eq. $Q = (P-0.2S)^2 / P+0.8S$

or $Q = (P-0.352)^2 / P+1.408$.

ECI-4 **ENGINEERING CONSULTANTS, INC.**

NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 1 OF
DISTRIBUTION OF HOURLY INCREMENTAL PMP VALUES JOB NO. 1212-001-1
COLD SPRING DAM BY KLB DATE 5-19-78

DISTRIBUTION OF HOURLY INCREMENTAL PMP VALUES

HOUR	%	INCREMENTAL PRECIP (IN)	ACCUMULATED PRECIP (IN)
1	10	2.0	2.0
2	12	2.4	4.4
3	15	3.0	7.4
4	38	7.6	15.0
5	14	2.8	17.8
6	11	2.2	20.0

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY DAM SAFETY INSPECTION-(DEP) SHEET NO. 1 OF

PMF DERIVATION – COLD SPRING JOB NO. 1212-001-1

DIRECT RUNOFF BY KLB DATE 7-21-78

DIRECT RUNOFF INCREMENTS FOR COMPUTING - PMF
according to EM 1110-2-163

TIME ENDING (HR)	INCREMENTAL DESIGN RAINFALL (IN)	ACCUMULATIVE DESIGN RAINFALL (IN)	DIRECT RUNOFF ACCUMULATIVE (IN)	DIRECT RUNOFF INCREMENTAL (IN)	INCREMENTAL LOSS (IN)
0.10	0.20	0.20	0.00	0.00	0.00
0.20	0.20	0.40	0.00	0.00	0.00
0.30	0.20	0.60	0.03	0.00	0.03
0.40	0.20	0.80	0.09	0.06	0.14
0.50	0.20	1.00	0.17	0.08	0.12
0.60	0.20	1.20	0.28	0.11	0.09
0.70	0.20	1.40	0.37	0.11	0.09
0.80	0.20	1.60	0.52	0.13	0.07
0.90	0.20	1.80	0.65	0.13	0.07
2.0 1.00	0.20	2.00	0.80	0.15	0.05
1.10	0.24	2.24	0.98	0.18	0.06
1.20	0.24	2.48	1.16	0.18	0.06
1.30	0.24	2.72	1.36	0.20	0.04
1.40	0.24	2.96	1.56	0.20	0.04
1.50	0.24	3.20	1.76	0.20	0.04
1.60	0.24	3.44	1.97	0.21	0.03
1.70	0.24	3.68	2.18	0.21	0.03
1.80	0.24	3.92	2.39	0.21	0.03
1.90	0.24	4.16	2.60	0.21	0.03
2.4 2.00	0.24	4.40	2.82	0.22	0.02
2.10	0.30	4.70	3.10	0.28	0.02
2.20	0.30	5.00	3.37	0.27	0.03
2.30	0.30	5.30	3.65	0.28	0.02
2.40	0.30	5.60	3.93	0.28	0.02
2.50	0.30	5.90	4.21	0.28	0.02
2.60	0.30	6.20	4.50	0.29	0.01*
2.70	0.30	6.50	4.78	0.29	0.01
2.80	0.30	6.80	5.07	0.29	0.01
2.90	0.30	7.10	5.35	0.29	0.01
3.0 3.00	0.30	7.40	5.64	0.29	0.01

* MINIMUM LOSS RATE = 0.12"/HR = 0.012"/.1HR SAY 0.01"/.1HR
(AFTER THIS RATE IS REACHED, ABANDON CURVE FOR CONSTANT LOSS)

ENGINEERING CONSULTANTS, INC.

NEW JERSEY DAM SAFETY INSPECTION - (DEP) SHEET NO. 2 OF
PMF DERIVATION - COLD SPRING JOB NO. 1212-001-1
DIRECT RUNOFF CONT. BY KLB DATE 7-24-78

DIRECT RUNOFF INCREMENTS FOR COMPUTING - PMF

TIME ENDING (HR)	INCREMENTAL DESIGN RAINFALL (IN)	ACCUMULATIVE DESIGN RAINFALL (IN)	DIRECT RUNOFF ACCUMULATIVE (IN)	DIRECT RUNOFF INCREMENTAL (IN)	INCREMENTAL LOSS (IN)
3.10	0.75	8.15	6.36	0.74	0.01
3.20	0.75	8.90	7.09	0.74	0.01
3.30	0.75	9.65	7.82	0.74	0.01
3.40	0.75	10.40	8.55	0.74	0.01
3.50	0.75	11.15	9.28	0.74	0.01
3.60	0.90	12.05	10.17	0.89	0.01
3.70	0.75	12.80	10.91	0.74	0.01
3.80	0.75	13.55	11.65	0.74	0.01
3.90	0.75	14.30	12.39	0.74	0.01
4.00	0.73	15.03	13.11	0.72	0.01
4.10	0.28	15.31	13.38	0.27	0.01
4.20	0.28	15.59	13.66	0.27	0.01
4.30	0.28	15.87	13.94	0.27	0.01
4.40	0.28	16.15	14.21	0.27	0.01
4.50	0.28	16.43	14.49	0.27	0.01
4.60	0.28	16.71	15.00	0.27	0.01
4.70	0.28	16.99	15.05	0.27	0.01
4.80	0.28	17.27	15.32	0.27	0.01
4.90	0.28	17.55	15.84	0.27	0.01
5.00	0.28	17.83	15.88	0.27	0.01
5.10	0.22	18.05	16.10	0.21	0.01
5.20	0.22	18.27	16.32	0.21	0.01
5.30	0.22	18.49	16.53	0.21	0.01
5.40	0.22	18.71	16.75	0.21	0.01
5.50	0.22	18.99	17.03	0.21	0.01
5.60	0.22	19.15	17.19	0.21	0.01
5.70	0.22	19.37	17.41	0.21	0.01
5.80	0.22	19.59	17.63	0.21	0.01
5.90	0.22	19.81	17.84	0.21	0.01
6.00	0.22	20.03	18.06	0.21	0.01

* MINIMUM LOSS RATE = 0.12"/HR = 0.012"/.1 HR SAY 0.01"/.1HR
(AFTER THIS RATE IS REACHED, ABANDON CURVE FOR CONSTANT LOSSES)

NEW JERSEY (STATE) DAM SAFETY INSPECTION — SHEET NO. 1 OF 1

COLD SPRINGS LAKE DAM — JOB NO. 1211-001-1

100 YR DEPTH DURATION VALUES — BY KLB DATE 9-20-78

COLD SPRINGS LAKE DAM
PASSAIC COUNTY NEW JERSEY

a) PMP 6 HR RAINFALL ≅ 25 in
(SMALL DAMS, FIG 15, Pg 48)

b) RATIO 100 YR 6HR TO PMP 6HR

1 : 4.8

(TP 40, CHART 51)

c.) 100 YR 6HR RAINFALL

$= 25.0 \times \frac{1}{4.8} = 5.2$

d) CHECK WITH TP 40 100 YR, 6HR RAINFALL

= 5.2 (TP 40, CHART 35)

∴ SMALL DAMS AND TP 40 DATA
AGREE ON 100 YR 6HR PRECIPITATION.
TP 40 MAY BE USED FOR OTHER
DURATIONS OF 100 YR RAINFALL
NEAR COLD SPRINGS LAKE DAM.

ECI-4 **ENGINEERING CONSULTANTS, INC.**

NEW JERSEY (STATE) DAM SAFETY INSPECTION SHEET NO. 1 OF

COLD SPRING LAKE DAM JOB NO. 1211-001-1

100 YR DEPTH-DURATION VALUES BY KLB DATE 9-20-78

LOCATION PASSAIC COUNTY, NEW JERSEY

RAINFALL INTENSITY - DURATION DATA

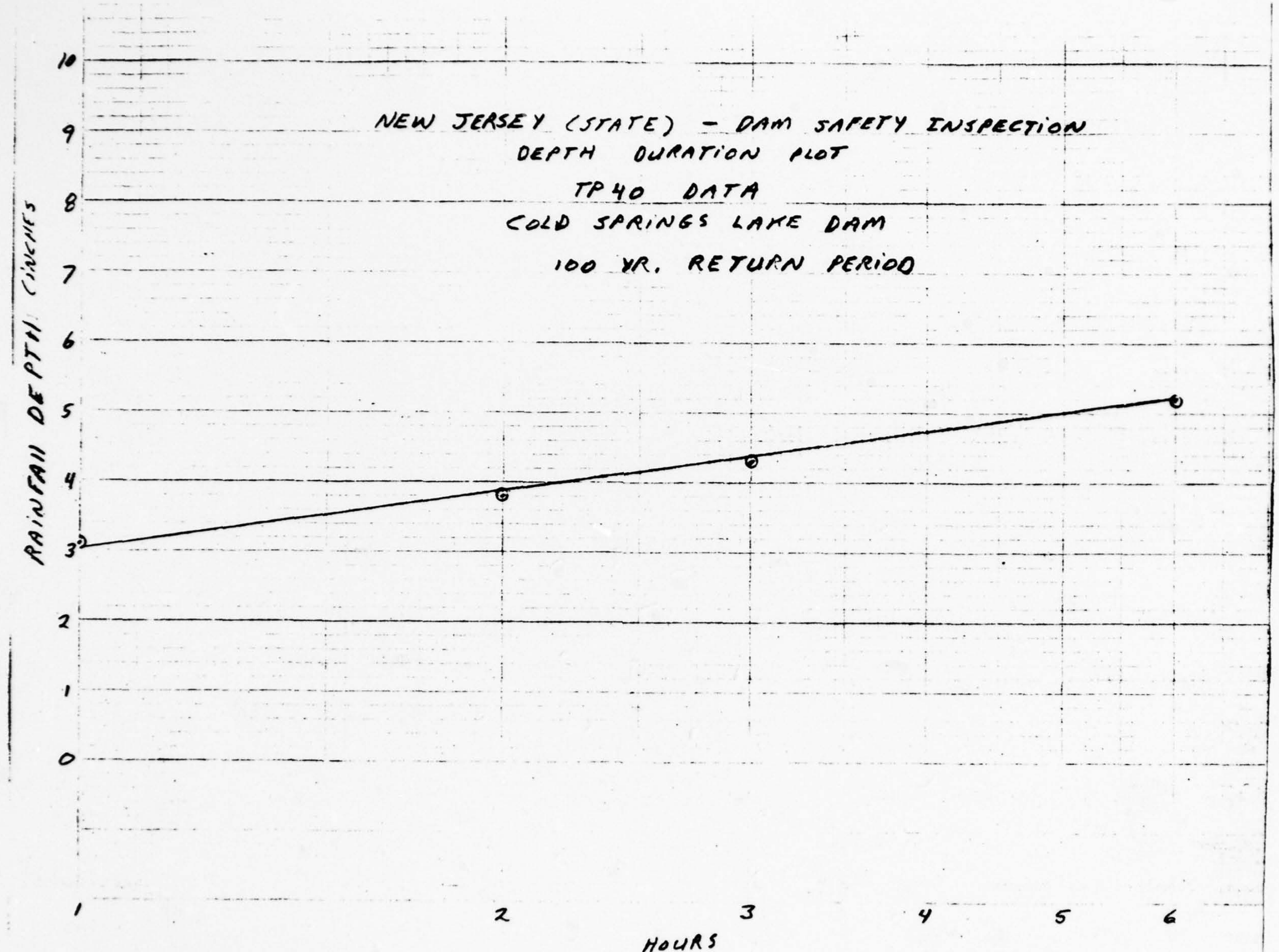
RETURN PERIOD = 100 YR

DURATION (HR)	TOTAL DEPTH (IN)	RAINFALL INTENSITY (IN/HR)	TP 40 CHART NO.
.5	2.3	4.6	7
1.0	3.1	3.1	14
2.0	3.8	1.9	21
3.0	4.3	1.4	28
6.0	5.2	0.9	35
12.0	6.3	0.5	42
24.0	7.2	0.3	49

LOSS RATE:

0.5 IN/HR 0 - 1 HR

0.1 IN/HR 1 - 6 HR


NEW JERSEY (STATE) - DAM SAFETY INSPECTION
DEPTH DURATION PLOT
TP40 DATA
COLD SPRINGS LAKE DAM
100 YR. RETURN PERIOD
RAINFALL DEPTH (INCHES
0
1
2
3
4
5
6
7
8
9
10
1
2
3
4
5
6
HOURS

C1-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) - DAM SAFETY — SHEET NO. 1 OF ____

COLD SPRINGS LAKE DAM — JOB NO. 1211 -001-1

100 YR RAINFALL DISTRIBUTION — BY KLB DATE 9-21-78

DATA FROM SMALL DAMS
(FIG 17, Pg 51)

TIME (HR)	RAINFALL RATIO TO 6 HR TOTAL	RAINFALL RATIO TO 1 HR TOTAL
0.1	0.07	0.15
0.2	0.12	0.27
0.3	0.17	0.40
0.4	0.25	0.52
0.5	0.30	0.63
0.6	0.34	0.71
0.7	0.38	0.79
0.8	0.42	0.88
0.9	0.45	0.94
1.0	0.48	1.00

ECI-4 **ENGINEERING CONSULTANTS, INC.**

NEW JERSEY (STATE) - DAM SAFETY INSPECTION SHEET NO. 2 OF

COLD SPRINGS LAKE DAM JOB NO. 1211-001-1

100 YR RAINFALL DISTRIBUTION BY KLB DATE 9-21-78

TIME (HR)	RATIO TO 1 HR STORM (FROM SMALL DAMS)	TOTAL DEPTH (IN)	INCREMENTAL DEPTH (IN)	LOSS (IN)	EXCESS PRECIP
0.1	0.15	0.47	0.47	0.05	0.42
0.2	0.27	0.84	0.37	0.05	0.32
0.3	0.40	1.24	0.40	0.05	0.35
0.4	0.52	1.61	0.37	0.05	0.32
0.5	0.63	1.95	0.34	0.05	0.29
0.6	0.71	2.20	0.25	0.05	0.20
0.7	0.79	2.45	0.25	0.05	0.20
0.8	0.87	2.70	0.25	0.05	0.20
0.9	0.94	2.91	0.21	0.05	0.16
1.0	1.00	3.10	0.19	0.05	0.14
2.0	-	3.80	0.70	0.10	0.60
3.0	-	4.30	0.50	0.10	0.40
4.0	-	4.70	0.40	0.10	0.30
5.0	-	4.95	0.25	0.10	0.15
6.0	-	5.20	0.25	0.10	0.15

1 HR INCREMENTAL DEPTHS FROM LOG PLOT OF TP 40 DATA

0.1 HR INCREMENTS IN FIRST HOUR ARE DISTRIBUTED ACCORDING TO SMALL DAMS, (FIG 15, Pg 51)

ASSUME .1 HR INCREMENTS FOR HOURS 1 TO 6 ARE DISTRIBUTED UNIFORMILY IN EACH HOUR

ECI-4 **ENGINEERING CONSULTANTS, INC.**

NEW JERSEY DAM SAFETY INSPECTION -(DEP) SHEET NO. 1 OF

INPUT FOR HEC-1, COLD SPRINGS DAM JOB NO. 1212-001-1

Y2-Y3 CARD BY KLB DATE 2-21-78

INPUT TO HEC-1 (FROM CURVES)

	#	ELEV (FT)	Y2 STORAGE (AC-FT)	Y3 DISCHARGE (CFS)
SPILLWAY CREST	1	410.00	208.0	0.
	2	411.00	215.8	20.
	3	411.50	219.8	100.
	4	411.75	221.7	200.
TOP OF DAM	5	412.00	223.8	350.
	6	412.25	225.8	550.
	7	412.50	227.8	820.
	8	413.00	232.0	1520.
	9	414.00	240.0	3320.
	10	415.00	248.0	5550.

****
HEC-1 VERSION DATED JAN 1973

****

DAM SAFETY INSPECTION - NEW JERSEY STATE
COLD SPRING LAKE DAM
PMF FLOOD ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
80	0	6	0	0	0	0	0	0	0

JOPER	NWT
3	0

**********   **********   **********   **********   **********

SUB-AREA RUNOFF COMPUTATION

INPUT UNIT HYDROGRAPH DERIVED FROM SCS METHOD

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
6	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	1.50	0.00	1.50	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
60	0.00	0.00	0.00

PRECIP PATTERN

0.00	0.00	0.00	0.06	0.08	0.11	0.11	0.13	0.13	0.15
0.18	0.18	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.22
0.28	0.27	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29
0.74	0.74	0.74	0.74	0.74	0.89	0.74	0.74	0.74	0.74
0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GIVEN UNIT GRAPH, NUHGQ= 14

0.	625.	2200.	2689.	1800.	1025.	590.	350.	200.	125.
70.	40.	20.	10.						

UNIT GRAPH TOTALS 9744. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.00	0.00	0.
2	0.00	0.00	0.
3	0.00	0.00	0.
4	0.00	0.00	0.

5	0.08	0.08	37.
6	0.11	0.11	181.
7	0.11	0.11	406.
8	0.13	0.13	633.
9	0.13	0.13	824.
10	0.15	0.15	978.
11	0.18	0.18	1108.
12	0.18	0.18	1243.
13	0.20	0.20	1405.
14	0.20	0.20	1559.
15	0.20	0.20	1692.
16	0.21	0.21	1797.
17	0.21	0.21	1868.
18	0.21	0.21	1927.
19	0.21	0.21	1976.
20	0.22	0.22	2006.
21	0.28	0.28	2030.
22	0.27	0.27	2099.
23	0.28	0.28	2258.
24	0.28	0.28	2424.
25	0.28	0.28	2539.
26	0.29	0.29	2617.
27	0.29	0.29	2670.
28	0.29	0.29	2720.
29	0.29	0.29	2762.
30	0.29	0.29	2790.
31	0.74	0.74	2805.
32	0.74	0.74	3096.
33	0.74	0.74	4091.
34	0.74	0.74	5304.
35	0.74	0.74	6115.
36	0.89	0.89	6577.
37	0.74	0.74	6937.
38	0.74	0.74	7331.
39	0.74	0.74	7494.
40	0.74	0.74	7417.
41	0.27	0.27	7332.
42	0.27	0.27	6991.
43	0.27	0.27	5930.
44	0.27	0.27	4648.
45	0.27	0.27	3791.
46	0.27	0.27	3301.
47	0.27	0.27	3019.
48	0.27	0.27	2852.
49	0.27	0.27	2756.
50	0.27	0.27	2696.
51	0.21	0.21	2663.
52	0.21	0.21	2607.
53	0.21	0.21	2466.
54	0.21	0.21	2300.
55	0.21	0.21	2192.
56	0.21	0.21	2130.
57	0.21	0.21	2095.
58	0.21	0.21	2074.
59	0.21	0.21	2062.
60	0.21	0.21	2054.
61	0.00	0.00	2050.
62	0.00	0.00	1916.
63	0.00	0.00	1453.
64	0.00	0.00	888.
65	0.00	0.00	510.

66	0.00	0.00	295.
67	0.00	0.00	171.
68	0.00	0.00	97.
69	0.00	0.00	55.
70	0.00	0.00	29.
71	0.00	0.00	14.
72	0.00	0.00	6.
73	0.00	0.00	2.
74	0.00	0.00	0.
75	0.00	0.00	0.
76	0.00	0.00	0.
77	0.00	0.00	0.
78	0.00	0.00	0.
79	0.00	0.00	0.
80	0.00	0.00	0.
SUM	17.98	17.98	175197.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7494.	2910.	2189.	2189.	175196.
INCHES		18.04	18.10	18.10	18.10
AC-FT		1443.	1448.	1448.	1448.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU COLD SPRING LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
6	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	208.	215.	219.	221.	223.	225.	227.	232.	240.	248.
OUTFLOW=	0.	20.	100.	200.	350.	550.	[illegible]	1520.	3220.	5550.

TIME	EOP STOR	AVG IN	EOP OUT
1	208.	0.	0.
2	208.	0.	0.
3	208.	0.	0.
4	208.	0.	0.
5	208.	18.	0.
6	209.	109.	2.
7	211.	294.	8.
8	215.	519.	19.
9	220.	729.	150.
10	225.	901.	523.
11	228.	1043.	899.
12	229.	1175.	11[illegible]
13	230.	1324.	1288.
14	231.	1482.	1446.
15	232.	1626.	1603.
16	233.	1744.	1735.

17	233.	1832.	1826.
18	233.	1898.	1893.
19	234.	1952.	1948.
20	234.	1991.	1988.
21	234.	2018.	2016.
22	234.	2065.	2062.
23	235.	2179.	2171.
24	235.	2341.	2330.
25	236.	2482.	2472.
26	236.	2578.	2571.
27	237.	2643.	2639.
28	237.	2695.	2691.
29	237.	2741.	2738.
30	237.	2776.	2774.
31	238.	2798.	2796.
32	238.	2951.	2941.
33	241.	3593.	3607.
34	245.	4697.	4798.
35	248.	5709.	5794.
36	250.	6346.	6397.
37	252.	6757.	6790.
38	253.	7134.	7165.
39	254.	7412.	7435.
40	254.	7456.	7457.
41	254.	7375.	7367.
42	253.	7162.	7143.
43	250.	6461.	6398.
44	246.	5289.	5187.
45	243.	4220.	4131.
46	240.	3546.	3492.
47	239.	3160.	3143.
48	238.	2936.	2949.
49	238.	2804.	2814.
50	237.	2726.	2732.
51	237.	2680.	2683.
52	237.	2635.	2638.
53	236.	2556.	2543.
54	236.	2383.	2393.
55	235.	2246.	2255.
56	235.	2161.	2167.
57	234.	2112.	2116.
58	234.	2084.	2086.
59	234.	2068.	2069.
60	234.	2058.	2059.
61	234.	2052.	2052.
62	234.	1983.	1988.
63	232.	1685.	1704.
64	230.	1170.	1245.
65	227.	699.	802.
66	225.	402.	522.
67	223.	283.	353.
68	222.	134.	232.
69	221.	76.	178.
70	220.	42.	129.
71	219.	22.	96.
72	218.	10.	83.
73	218.	4.	71.
74	217.	1.	60.
75	217.	0.	51.
76	216.	0.	43.
77	216.	0.	36.

AD-A060 016 HARRIS ECI ASSOCIATES WOODRRIDGF NJ F/G 13/2
NATIONAL DAM SAFETY PROGRAM. COLD SPRING LAKF DAM (NJ00226), PA--ETC(U)
AUG 78 R GERSHOWITZ DACW61-78-C-0124

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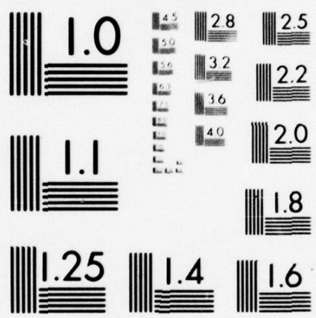

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

78	216.	0.	31.	
79	216.	0.	26.	
80	215.	0.	22.	
SUM			174249.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7457.	2890.	2178.	2178.	174249.
INCHES		17.92	18.01	18.01	18.01
AC-FT		1433.	1440.	1440.	1440.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	6	7494.	2910.	2189.	2189.	1.50
ROUTED TO	6	7457.	2890.	2178.	2178.	1.50

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*****************************
HEC-1 VERSION DATED JAN 1973

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                          DAM SAFETY INSPECTION - NEW JERSEY STATE
                                  COLD SPRING LAKE DAM
                            ONE HALF PMF FLOOD ROUTING

                              JOB SPECIFICATION
               NQ    NHR   NMIN   IDAY    IHR   IMIN METRC   IPLT   IPRT NSTAN
               80      0      0      0      0      0      0      0      0      0
                                 JOPER    NWT
                                     3      0


     **********      **********      **********      **********      **********

                           SUB-AREA RUNOFF COMPUTATION

                      INPUT UNIT HYDROGRAPH DERIVED FROM SCS METHOD

               ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME
                   6       0       0       0       0       0       1

                                 HYDROGRAPH DATA
       IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
           0      -1    1.50    0.00    1.50    0.00   0.500       0       0       0

                                   PRECIP DATA
                            NP   STORM     DAJ     DAK
                            60    0.00    0.00    0.00
                                 PRECIP PATTERN
    0.00     0.00     0.00     0.06     0.08     0.11     0.11     0.13     0.13     0.15
    0.18     0.18     0.20     0.20     0.20     0.21     0.21     0.21     0.21     0.22
    0.28     0.27     0.28     0.28     0.28     0.29     0.29     0.29     0.29     0.29
    0.74     0.74     0.74     0.74     0.74     0.89     0.74     0.74     0.74     0.74
    0.27     0.27     0.27     0.27     0.27     0.27     0.27     0.27     0.27     0.27
    0.21     0.21     0.21     0.21     0.21     0.21     0.21     0.21     0.21     0.21

                                    LOSS DATA
       STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

                           GIVEN UNIT GRAPH, NUHGQ=   14
      0.     625.    2290.    2689.    1800.    1025.     590.     350.     200.     125.
     70.      40.      20.      10.
                  UNIT GRAPH TOTALS    9744. CFS OR 1.00 INCHES OVER THE AREA

                                 RECESSION DATA
                  STRTQ=    0.00    QRCSN=    0.00    RTIOR= 1.00

                               END-OF-PERIOD FLOW
                          TIME   RAIN   EXCS     COMP Q
                             1   0.00   0.00         0.
                             2   0.00   0.00         0.
                             3   0.00   0.00         0.
                             4   0.06   0.06         0.
```

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	6	7494.	2910.	2189.	2189.	1.50
ROUTED TO	6	7457.	2890.	2176.	2178.	1.50

5	0.08	0.08	37.
6	0.11	0.11	181.
7	0.11	0.11	406.
8	0.13	0.13	633.
9	0.13	0.13	824.
10	0.15	0.15	978.
11	0.18	0.18	1108.
12	0.18	0.18	1243.
13	0.20	0.20	1405.
14	0.20	0.20	1559.
15	0.20	0.20	1692.
16	0.21	0.21	1797.
17	0.21	0.21	1868.
18	0.21	0.21	1927.
19	0.21	0.21	1976.
20	0.22	0.22	2006.
21	0.26	0.28	2030.
22	0.27	0.27	2099.
23	0.28	0.28	2258.
24	0.28	0.28	2424.
25	0.28	0.28	2539.
26	0.29	0.29	2617.
27	0.29	0.29	2670.
28	0.29	0.29	2720.
29	0.29	0.29	2762.
30	0.29	0.29	2790.
31	0.74	0.74	2805.
32	0.74	0.74	3096.
33	0.74	0.74	4091.
34	0.74	0.74	5304.
35	0.74	0.74	6115.
36	0.89	0.89	6577.
37	0.74	0.74	6937.
38	0.74	0.74	7331.
39	0.74	0.74	7494.
40	0.74	0.74	7417.
41	0.27	0.27	7332.
42	0.27	0.27	6991.
43	0.27	0.27	5930.
44	0.27	0.27	4648.
45	0.27	0.27	3791.
46	0.27	0.27	3301.
47	0.27	0.27	3019.
48	0.27	0.27	2852.
49	0.27	0.27	2756.
50	0.27	0.27	2696.
51	0.21	0.21	2663.
52	0.21	0.21	2607.
53	0.21	0.21	2466.
54	0.21	0.21	2300.
55	0.21	0.21	2192.
56	0.21	0.21	2130.
57	0.21	0.21	2095.
58	0.21	0.21	2074.
59	0.21	0.21	2062.
60	0.21	0.21	2054.
61	0.00	0.00	2050.
62	0.00	0.00	1916.
63	0.00	0.00	1488.
64	0.00	0.00	888.
65	0.00	0.00	510.

```
              66   0.00   0.00      295.
              67   0.00   0.00      171.
              68   0.00   0.00       97.
              69   0.00   0.00       55.
              70   0.00   0.00       29.
              71   0.00   0.00       14.
              72   0.00   0.00        6.
              73   0.00   0.00        2.
              74   0.00   0.00        0.
              75   0.00   0.00        0.
              76   0.00   0.00        0.
              77   0.00   0.00        0.
              78   0.00   0.00        0.
              79   0.00   0.00        0.
              80   0.00   0.00        0.

             SUM  17.98  17.98   175197.

             PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
      CFS    7494.    2910.     2189.     2189.      175196.
   INCHES             18.04     18.10     18.10        18.10
    AC-FT              1443.     1448.     1448.        1448.

                  RUNOFF MULTIPLIED BY 0.50
     0.      0.      0.      0.     18.     90.    203.    316.    412.    489.
   554.    621.    702.    779.    846.    898.    934.    963.    988.   1003.
  1015.   1049.   1129.   1212.   1269.   1308.   1335.   1360.   1381.   1395.
  1402.   1548.   2045.   2652.   3057.   3288.   3468.   3665.   3747.   3708.
  3666.   3495.   2965.   2324.   1895.   1650.   1509.   1426.   1378.   1348.
  1331.   1303.   1233.   1150.   1096.   1065.   1047.   1037.   1031.   1027.
  1025.    958.    726.    444.    255.    147.     85.     48.     27.     14.
     7.      3.      1.      0.      0.      0.      0.      0.      0.      0.

             PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
      CFS    3747.    1455.     1094.     1094.       87598.
   INCHES              9.02      9.05      9.05         9.05
    AC-FT              721.      724.      724.         724.


**********        **********        **********        **********        **********

                       HYDROGRAPH ROUTING

               ROUTE HYDROGRAPH THRU COLD SPRING LAKE DAM

          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME
              6       1       0       0       2       0       1
                              ROUTING DATA
                  QLOSS   CLOSS     AVG    IRES   ISAME
                    0.0   0.000    0.00       1       0

          NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA
              0       0       0   0.000   0.000   0.000     -1.

STORAGE=    208.    215.    219.    221.    223.    225.    227.    232.    240.    248.
OUTFLOW=      0.     20.    100.    200.    350.    550.    820.   1520.   3220.   5950.

                  TIME  EOP STOR   AVG IN   EOP OUT
                     1      208.       0.        0.
```

2	208.	0.	0.
3	208.	0.	0.
4	208.	0.	0.
5	208.	9.	0.
6	208.	54.	1.
7	209.	147.	4.
8	211.	259.	9.
9	214.	364.	17.
10	218.	450.	65.
11	221.	521.	182.
12	223.	587.	366.
13	225.	662.	539.
14	226.	741.	681.
15	227.	813.	775.
16	227.	872.	848.
17	228.	916.	903.
18	228.	949.	940.
19	228.	976.	969.
20	228.	995.	990.
21	228.	1009.	1005.
22	229.	1032.	1027.
23	229.	1089.	1078.
24	229.	1170.	1153.
25	230.	1241.	1225.
26	230.	1289.	1277.
27	230.	1321.	1313.
28	230.	1347.	1341.
29	231.	1370.	1365.
30	231.	1388.	1384.
31	231.	1399.	1396.
32	231.	1475.	1460.
33	233.	1796.	1766.
34	235.	2348.	2311.
35	238.	2854.	2819.
36	239.	3173.	3150.
37	240.	3378.	3388.
38	241.	3567.	3583.
39	241.	3706.	3717.
40	241.	3728.	3728.
41	241.	3687.	3683.
42	241.	3581.	3571.
43	239.	3230.	3202.
44	237.	2644.	2681.
45	234.	2110.	2147.
46	233.	1773.	1797.
47	232.	1580.	1594.
48	231.	1468.	1481.
49	231.	1402.	1417.
50	231.	1365.	1373.
51	230.	1340.	1346.
52	230.	1317.	1323.
53	230.	1268.	1278.
54	230.	1191.	1207.
55	229.	1123.	1138.
56	229.	1080.	1091.
57	229.	1056.	1062.
58	229.	1042.	1046.
59	229.	1034.	1036.
60	229.	1029.	1030.
61	229.	1026.	1027.
62	228.	991.	998.

63	228.	842.	871.
64	226.	585.	660.
65	224.	349.	458.
66	223.	201.	317.
67	222.	116.	225.
68	221.	67.	163.
69	220.	38.	118.
70	219.	21.	93.
71	218.	11.	80.
72	218.	5.	69.
73	217.	2.	58.
74	217.	0.	49.
75	216.	0.	42.
76	216.	0.	35.
77	216.	0.	30.
78	216.	0.	25.
79	215.	0.	21.
80	215.	0.	19.
SUM			86673.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3728.	1435.	1083.	1083.	86673.
INCHES		8.90	8.95	8.95	8.95
AC-FT		712.	716.	716.	716.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	6	3747.	1455.	1094.	1094.	1.50
ROUTED TO	6	3728.	1455.	1088.	1083.	1.50

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HEC-1 VERSION DATED JAN 1973

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                         DAM SAFETY INSPECTION - NEW JERSEY STATE
                                   COLD SPRING LAKE DAM
                              100 YEAR FLOOD ROUTING

                                  JOB SPECIFICATION
              NQ     NHR    NMIN   IDAY    IHR   IMIN METRC   IPLT   IPRT NSTAN
              80       0       6      0      0      0      0      0      0      0
                                  JOPER    NWT
                                      3      0


   **********          **********          **********          **********          **********

                              SUB-AREA RUNOFF COMPUTATION

                         INPUT UNIT HYDROGRAPH DERIVED FROM SCS METHOD

              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME
                  6       0       0       0       0       0       1

                                    HYDROGRAPH DATA
       IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
           0      -1    1.50    0.00    1.50    0.00   0.000       0       0       0

                                     PRECIP DATA
                             NP   STORM     DAJ     DAK
                             60    0.00    0.00    0.00
                                    PRECIP PATTERN
     0.42     0.32     0.35     0.32     0.29     0.20     0.20     0.20     0.16     0.14
     0.06     0.06     0.06     0.06     0.06     0.06     0.06     0.06     0.06     0.06
     0.04     0.04     0.04     0.04     0.04     0.04     0.04     0.04     0.04     0.04
     0.03     0.03     0.03     0.03     0.03     0.03     0.03     0.03     0.03     0.03
     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01
     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01

                                      LOSS DATA
        STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
         0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

                            GIVEN UNIT GRAPH, NUHGQ=   14
       0.     625.    2200.    2689.    1800.    1025.     590.     350.     200.     125.
      70.      40.      20.      10.
               UNIT GRAPH TOTALS   9744. CFS OR 1.00 INCHES OVER THE AREA

                                    RECESSION DATA
                  STRTQ=    0.00    QRCSN=    0.00    RTIOR= 1.00

                                 END-OF-PERIOD FLOW
                          TIME   RAIN   EXCS     COMP Q
                             1   0.42   0.42         0.
                             2   0.32   0.32       262.
                             3   [illegible]   [illegible]      1124.
                             4   0.32   [illegible]   [illegible]
```

5	0.29	0.29	2586.
6	0.20	0.20	2832.
7	0.20	0.20	2829.
8	0.20	0.20	2615.
9	0.16	0.16	2355.
10	0.14	0.14	2162.
11	0.06	0.06	1964.
12	0.06	0.06	1707.
13	0.06	0.06	1370.
14	0.06	0.06	1056.
15	0.06	0.06	855.
16	0.06	0.06	739.
17	0.06	0.06	672.
18	0.06	0.06	633.
19	0.06	0.06	611.
20	0.06	0.06	598.
21	0.04	0.04	591.
22	0.04	0.04	574.
23	0.04	0.04	528.
24	0.04	0.04	474.
25	0.04	0.04	438.
26	0.04	0.04	417.
27	0.04	0.04	406.
28	0.04	0.04	399.
29	0.04	0.04	395.
30	0.04	0.04	392.
31	0.03	0.03	391.
32	0.03	0.03	384.
33	0.03	0.03	361.
34	0.03	0.03	334.
35	0.03	0.03	316.
36	0.03	0.03	306.
37	0.03	0.03	300.
38	0.03	0.03	296.
39	0.03	0.03	294.
40	0.03	0.03	298.
41	0.01	0.01	293.
42	0.01	0.01	283.
43	0.01	0.01	250.
44	0.01	0.01	209.
45	0.01	0.01	182.
46	0.01	0.01	167.
47	0.01	0.01	158.
48	0.01	0.01	153.
49	0.01	0.01	150.
50	0.01	0.01	148.
51	0.01	0.01	147.
52	0.01	0.01	146.
53	0.01	0.01	146.
54	0.01	0.01	146.
55	0.01	0.01	146.
56	0.01	0.01	146.
57	0.01	0.01	146.
58	0.01	0.01	146.
59	0.01	0.01	146.
60	0.01	0.01	146.
61	0.00	0.00	146.
62	0.00	0.00	[illegible]
63	0.00	0.00	[illegible]
64	0.00	0.00	83.
65	0.00	[illegible]	[illegible]

66	0.00	0.00	21.
67	0.00	0.00	12.
68	0.00	0.00	6.
69	0.00	0.00	3.
70	0.00	0.00	2.
71	0.00	0.00	1.
72	0.00	0.00	0.
73	0.00	0.00	0.
74	0.00	0.00	0.
75	0.00	0.00	0.
76	0.00	0.00	0.
77	0.00	0.00	0.
78	0.00	0.00	0.
79	0.00	0.00	0.
80	0.00	0.00	0.
SUM	4.10	4.10	40919.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2832.	675.	511.	511.	40924.
INCHES		4.18	4.22	4.22	4.22
AC-FT		335.	338.	338.	338.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THRU COLD SPRING LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
6	1	0	0	2	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	208.	215.	219.	221.	223.	225.	227.	232.	240.	248.
OUTFLOW=	0.	20.	100.	200.	350.	550.	820.	1520.	3220.	5580.

TIME	EOP STOR	AVG IN	EOP OUT
1	208.	0.	0.
2	209.	131.	2.
3	214.	693.	17.
4	225.	1588.	528.
5	234.	2319.	2005.
6	237.	2709.	2553.
7	238.	2831.	2820.
8	237.	2782.	2728.
9	236.	2485.	2501.
10	235.	[illegible]	2274.
11	234.	2063.	2077.
12	233.	1835.	1851.
13	232.	1558.	1559.
14	230.	1214.	1272.
15	228.	[illegible]	1015.
16	227.	[illegible]	837.

17	227.	706.	741.
18	226.	653.	678.
19	226.	622.	638.
20	226.	604.	614.
21	226.	594.	600.
22	226.	582.	587.
23	225.	551.	562.
24	225.	501.	524.
25	225.	456.	484.
26	224.	428.	451.
27	224.	411.	428.
28	224.	402.	413.
29	224.	397.	403.
30	224.	393.	397.
31	224.	391.	394.
32	224.	387.	390.
33	224.	372.	380.
34	223.	348.	361.
35	223.	325.	342.
36	223.	311.	328.
37	223.	303.	317.
38	223.	298.	308.
39	223.	295.	302.
40	223.	294.	298.
41	223.	293.	296.
42	222.	288.	292.
43	222.	266.	280.
44	222.	229.	257.
45	222.	196.	229.
46	221.	174.	204.
47	221.	162.	188.
48	221.	155.	176.
49	221.	151.	167.
50	220.	149.	161.
51	220.	147.	156.
52	220.	146.	153.
53	220.	146.	150.
54	220.	146.	149.
55	220.	146.	148.
56	220.	146.	147.
57	220.	146.	146.
58	220.	146.	146.
59	220.	146.	146.
60	220.	146.	146.
61	220.	146.	146.
62	220.	141.	144.
63	220.	120.	135.
64	220.	83.	117.
65	219.	49.	97.
66	219.	28.	86.
67	218.	16.	75.
68	218.	9.	65.
69	217.	5.	56.
70	217.	3.	48.
71	216.	1.	41.
72	216.	0.	35.
73	216.	0.	29.
74	216.	0.	25.
75	215.	0.	21.
76	215.	0.	19.
77	215.		19.

78	215.	0.	18.
79	215.	0.	18.
80	215.	0.	18.

SUM 40077.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9820.	654.	500.	500.	40077.
INCHES		4.05	4.14	4.14	4.14
AC-FT		324.	331.	331.	331.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	6	2832.	675.	511.	511.	1.50
ROUTED TO	6	2820.	654.	500.	500.	1.50

RESERVOIR DRAWDOWN

C1-4 ENGINEERING CONSULTANTS, INC.

NEW JERSEY (STATE) - DAM SAFETY INSPECTION SHEET NO. 1 OF
COLD SPRING LAKE JOB NO. 1211-001-1
RESERVOIR DRAWDOWN STUDY BY KLB DATE 9-18-78

a) DISCHARGE VS. HEAD

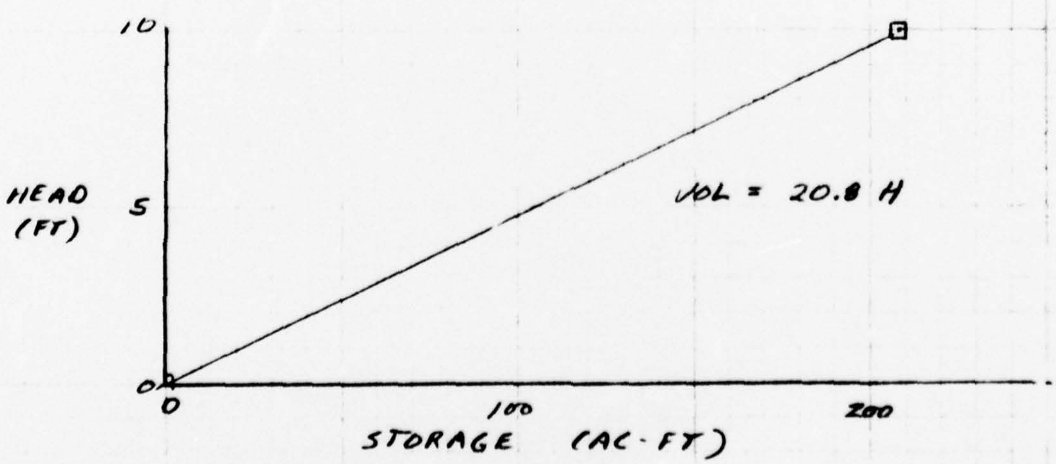
$$Q = 0.546\ A\sqrt{2gH}$$

SEE NOTES FOR RATING CURVE.

b) STORAGE VS. HEAD

ASSUME A STRAIGHT LINE RELATIONSHIP FROM NORMAL WATER SURFACE VOLUME TO ZERO VOLUME AT ZERO HEAD

	ELEV (FT)	HEAD (FT)	STORAGE (AC-FT)
NWS	410	10	208
	400	0	0



c) INFLOW; DRAINAGE AREA = 1.5 SQ. MI.

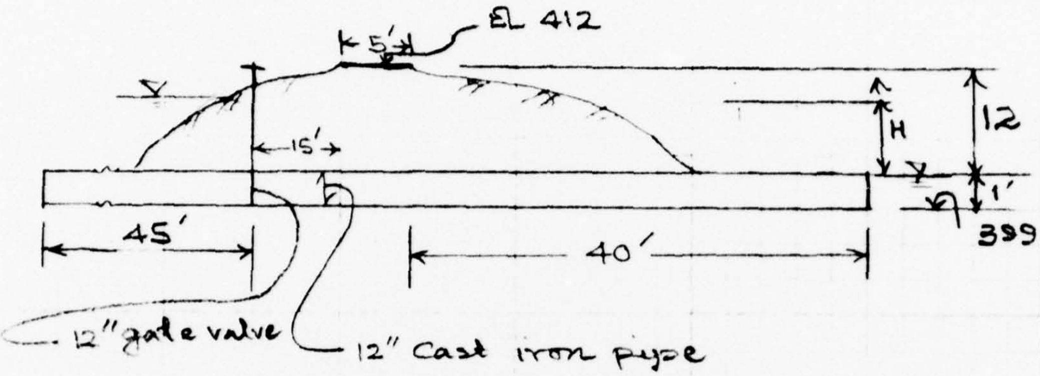
INFLOW = 2 CFS/SQ. MI × 1.5 SQ. MI. = 3 CFS

ECI-4 ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION — SHEET NO. 1 OF 3

COLD SPRING LAKE DAM — JOB NO. 1211-001

OUTLET RATING CURVE — BY MAS DATE 9/16/78



Note: All the dimensions are assumed dimensions. they may be far off from actual dimensions.

Outlet Discharges

Assume $K_e = 0.5$, $K_{valve} = 0.19$ (fully open).

$\epsilon = 0.00085$ and complete turbulence

$\frac{\epsilon}{D} = 0.00085 \Rightarrow f = 0.0158$ (complete turbulence, rough pipes)

$$H = \left(K_e + K_{valve} + \frac{fL}{D} + 1\right)\frac{V^2}{2g}$$

$$= \left(0.5 + 0.19 + \frac{0.0158 \times 105}{1} + 1\right)\frac{V^2}{2g}$$

$$= 3.35\,\frac{V^2}{2g}$$

$\therefore$ $\underline{\underline{V = 0.546\sqrt{2gH}}}$ (Assume this formula is applicable for all heads

$\therefore$ $Q = 0.546\,A\sqrt{2gH}$

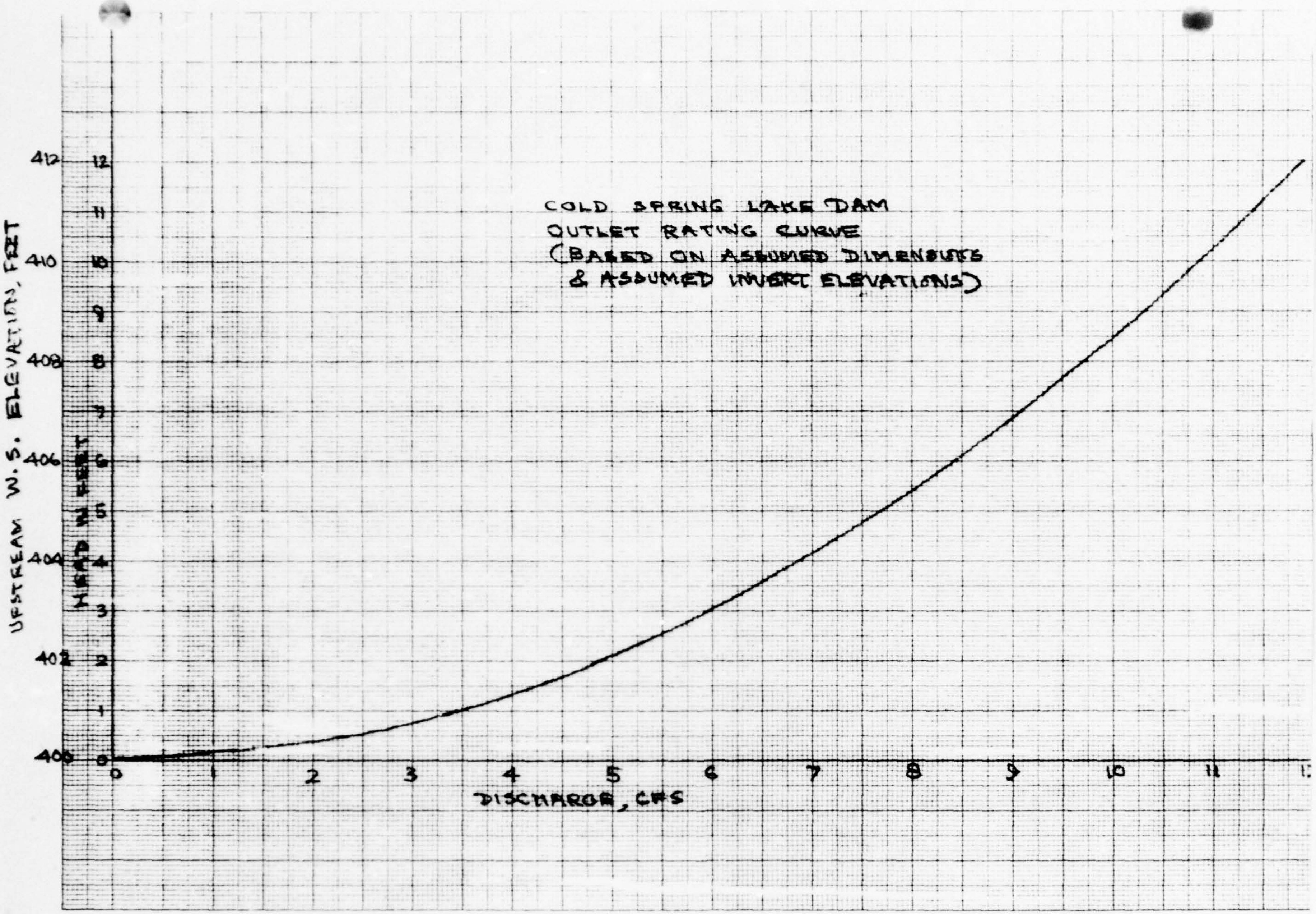
ENGINEERING CONSULTANTS, INC.

NEW HAMPSHIRE DAM SAFETY INSPECTION — SHEET NO. 2 OF 3

COLD SPRING LAKE DAM — JOB NO. 1211-001

OUTLET RATING CURVE — BY MAS — DATE 9/16/78

Upstream Water Surface elevation (feet)	Downstream W.S. elevation (feet)	Head, H, (feet)	Discharge $Q = .546A\sqrt{2gH}$ (cfs)	Remarks
401	400	1	3.44	
402	400	2	4.86	
403	400	3	5.96	
404	400	4	6.88	
405	400	5	7.69	
406	400	6	8.43	
407	400	7	9.10	
408	400	8	9.73	
409	400	9	10.32	
410	400	10	10.88	Recreation pool
411	400	11	11.41	
412	400	12	11.92	Top of dam


COLD SPRING LAKE DAM
OUTLET RATING CURVE
(BASED ON ASSUMED DIMENSIONS
& ASSUMED INVERT ELEVATIONS)
UPSTREAM W.S. ELEVATION, FEET
HEAD IN FEET
DISCHARGE, CFS
400
402
404
406
408
410
412
0
1
2
3
4
5
6
7
8
9
10
11
12

FLOOD ROUTING STUDY
****

COLD SPRINGS LAKE DAM DRAWDOWN STUDY (DA = 1.5 SQ. MI.)

1.0000 UNREGULATED DIVERSION CONDUIT AT ELEV 401.00 FT

MAXIMUM OPERATION LEVEL AT ELEV 410.00 FT (FROM OPERAT)
MINIMUM OPERATION LEVEL AT ELEV 401.00 FT

ROUTING STARTS AT ELEV 410.00 FT, ENDS AT ELEV 401.00 FT

TIME		AVG.INFLOW	RESERVOIR EL	MAIN SPILLWAY DISCHARGE	OVERFLOW SPILLWAY DISCHARGE	OUTLET DISCHARGE
DAY	HR	CFS	FT	CFS	CFS	CFS
0	0		410.00			
		0.				
0	6		409.73	0.	0.	11.
		0.				
0	12		409.47	0.	0.	11.
		0.				
0	18		409.20	0.	0.	10.
		0.				
1	0		408.94	0.	0.	10.
		0.				
1	6		408.69	0.	0.	10.
		0.				
1	12		408.44	0.	0.	10.
		0.				
1	18		408.19	0.	0.	10.
		0.				
2	0		407.95	0.	0.	10.
		0.				
2	6		407.71	0.	0.	10.
		0.				
2	12		407.47	0.	0.	9.
		0.				
2	18		407.24	0.	0.	9.
		0.				
3	0		407.01	0.	0.	9.
		0.				
3	6		406.79	0.	0.	9.
		0.				
3	12		406.56	0.	0.	9.
		0.				
3	18		406.35	0.	0.	9.
		0.				
4	0		406.13	0.	0.	9.
		0.				
4	6		405.92	0.	0.	8.

FLOOD ROUTING STUDY
****

TIME DAY	TIME HR	AVG. INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
		0.				
4	12		405.71	0.	0.	C.
		0.				
4	18		405.51	0.	0.	8.
		0.				
5	0		405.31	0.	0.	8.
		0.				
5	6		405.12	0.	0.	8.
		0.				
5	12		404.92	0.	0.	8.
		0.				
5	18		404.74	0.	0.	7.
		0.				
6	0		404.55	0.	0.	7.
		0.				
6	6		404.37	0.	0.	7.
		0.				
6	12		404.19	0.	0.	7.
		0.				
6	18		404.02	0.	0.	7.
		0.				
7	0		403.85	0.	0.	7.
		0.				
7	6		403.68	0.	0.	7.
		0.				
7	12		403.52	0.	0.	6.
		0.				
7	13		403.36	0.	0.	6.
		0.				
8	0		403.20	0.	0.	6.
		0.				
8	6		403.05	0.	0.	6.
		0.				
8	12		402.91	0.	0.	6.
		0.				
8	18		402.76	0.	0.	6.
		0.				
9	0		402.62	0.	0.	6.
		0.				
9	6		402.46	0.	0.	5.
		0.				
9	12		402.35	0.	0.	5.
		0.				
9	18		402.22	0.	0.	5.
		0.				
10	0		402.09	0.	0.	5.

TIME DAY	TIME HR	AVG.INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
		0.				
10	6		401.97	0.	0.	5.
		0.				
10	12		401.85	0.	0.	5.
		0.				
10	18		401.74	0.	0.	5.
		0.				
11	0		401.63	0.	0.	4.
		0.				
11	6		401.52	0.	0.	4.
		0.				
11	12		401.42	0.	0.	4.
		0.				
11	18		401.32	0.	0.	4.
		0.				
12	0		401.22	0.	0.	4.
		0.				
12	6		401.13	0.	0.	4.
		0.				
12	12		401.04	0.	0.	4.

****

RESERVOIR ELEVATION WENT UNDER MINIMUM WATERSURFACE ELEVATION
AFTER 12 DAYS AND 12 HOURS.

TOTAL INFLOW VOLUME 0. ACFT
TOTAL DISCHARGE VOLUME 186. ACFT

MAXIMUM WATER SURFACE ELEVATION 410.00 FT

MAXIMUM DISCHARGE THRU OUTLET CONDUIT 11. CFS

MAXIMUM TOTAL INFLOW 0. CFS
MAXIMUM TOTAL DISCHARGE 11. CFS

FLOOD ROUTING STUDY
****

COLD SPRINGS LAKE DAM DRAWDOWN STUDY (DA = 1.5 SQ. MI.)

1.0000 UNREGULATED DIVERSION CONDUIT AT ELEV 401.00 FT

MAXIMUM OPERATION LEVEL AT ELEV 410.00 FT (FROM OPERATI
MINIMUM OPERATION LEVEL AT ELEV 401.00 FT

ROUTING STARTS AT ELEV 410.00 FT, ENDS AT ELEV 401.00 FT

TIME DAY	HR	AVG.INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
0	0		410.00			
		3.				
0	6		409.80	0.	0.	11.
		3.				
0	12		409.61	0.	0.	11.
		3.				
0	18		409.42	0.	0.	11.
		3.				
1	0		409.24	0.	0.	10.
		3.				
1	6		409.05	0.	0.	10.
		3.				
1	12		408.87	0.	0.	10.
		3.				
1	18		408.69	0.	0.	10.
		3.				
2	0		408.51	0.	0.	10.
		3.				
2	6		408.34	0.	0.	10.
		3.				
2	12		408.17	0.	0.	10.
		3.				
2	18		408.00	0.	0.	10.
		3.				
3	0		407.83	0.	0.	10.
		3.				
3	6		407.67	0.	0.	10.
		3.				
3	12		407.51	0.	0.	9.
		3.				
3	18		407.35	0.	0.	9.
		3.				
4	0		407.19	0.	0.	9.
		3.				
4	6		407.04	0.	0.	9.

FLOOD ROUTING STUDY
****

TIME DAY	HR	AVG.INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
		3.				
4	12		406.89	0.	0.	9.
		3.				
4	18		406.74	0.	0.	9.
		3.				
5	0		406.59	0.	0.	9.
		3.				
5	6		406.45	0.	0.	9.
		3.				
5	12		406.30	0.	0.	9.
		3.				
5	18		406.17	0.	0.	9.
		3.				
6	0		406.03	0.	0.	8.
		3.				
6	6		405.89	0.	0.	8.
		3.				
6	12		405.76	0.	0.	8.
		3.				
6	18		405.63	0.	0.	8.
		3.				
7	0		405.50	0.	0.	8.
		3.				
7	6		405.38	0.	0.	8.
		3.				
7	12		405.26	0.	0.	8.
		3.				
7	18		405.14	0.	0.	8.
		3.				
8	0		405.02	0.	0.	8.
		3.				
8	6		404.90	0.	0.	8.
		3.				
8	12		404.79	0.	0.	8.
		3.				
8	18		404.67	0.	0.	7.
		3.				
9	0		404.57	0.	0.	7.
		3.				
9	6		404.46	0.	0.	7.
		3.				
9	12		404.35	0.	0.	7.
		3.				
9	18		404.25	0.	0.	7.
		3.				
0	0		404.15	0.	0.	7.

FLOOD ROUTING STUDY

TIME DAY	TIME HR	AVG. INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
10	6	3.	404.05	0.	0.	7.
10	12	3.	403.95	0.	0.	7.
10	18	3.	403.86	0.	0.	7.
11	0	3.	403.77	0.	0.	7.
11	6	3.	403.68	0.	0.	7.
11	12	3.	403.59	0.	0.	7.
11	18	3.	403.50	0.	0.	6.
12	0	3.	403.41	0.	0.	6.
12	6	3.	403.33	0.	0.	6.
12	12	3.	403.25	0.	0.	6.
12	18	3.	403.17	0.	0.	6.
13	0	3.	403.09	0.	0.	6.
13	6	3.	403.02	0.	0.	6.
13	12	3.	402.95	0.	0.	6.
13	18	3.	402.87	0.	0.	6.
14	0	3.	402.80	0.	0.	6.
14	6	3.	402.74	0.	0.	6.
14	12	3.	402.67	0.	0.	6.
14	18	3.	402.61	0.	0.	6.
15	0	3.	402.54	0.	0.	5.
15	6	3.	402.48	0.	0.	5.
15	12	3.	402.42	0.	0.	5.
15	18	3.	402.36	0.	0.	5.

FLOOD ROUTING STUDY

****

TIME DAY	TIME HR	AVG.INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
16	0	3.	402.31	0.	0.	5.
16	6	3.	402.25	0.	0.	5.
16	12	3.	402.20	0.	0.	5.
16	18	3.	402.15	0.	0.	5.
17	0	3.	402.10	0.	0.	5.
17	6	3.	402.05	0.	0.	5.
17	12	3.	402.00	0.	0.	5.
17	18	3.	401.96	0.	0.	5.
18	0	3.	401.91	0.	0.	5.
18	6	3.	401.87	0.	0.	5.
18	12	3.	401.83	0.	0.	5.
18	18	3.	401.79	0.	0.	5.
19	0	3.	401.75	0.	0.	5.
19	6	3.	401.71	0.	0.	4.
19	12	3.	401.67	0.	0.	4.
19	18	3.	401.64	0.	0.	4.
20	0	3.	401.61	0.	0.	4.
20	6	3.	401.57	0.	0.	4.
20	12	3.	401.54	0.	0.	4.
20	18	3.	401.51	0.	0.	4.
21	0	3.	401.48	0.	0.	4.
21	6	3.	401.45	0.	0.	4.
21	12	3.	401.43	0.	0.	4.

FLOOD ROUTING STUDY
****

TIME DAY	TIME HR	AVG.INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
		3.				
21	18		401.40	0.	0.	4.
		3.				
22	0		401.37	0.	0.	4.
		3.				
22	6		401.35	0.	0.	4.
		3.				
22	12		401.32	0.	0.	4.
		3.				
22	18		401.30	0.	0.	4.
		3.				
23	0		401.28	0.	0.	4.
		3.				
23	6		401.26	0.	0.	4.
		3.				
23	12		401.24	0.	0.	4.
		3.				
23	18		401.22	0.	0.	4.
		3.				
24	0		401.20	0.	0.	4.
		3.				
24	6		401.18	0.	0.	4.
		3.				
24	12		401.16	0.	0.	4.
		3.				
24	18		401.14	0.	0.	4.
		3.				
25	0		401.12	0.	0.	4.
		3.				
25	6		401.11	0.	0.	4.
		3.				
25	12		401.09	0.	0.	4.
		3.				
25	18		401.08	0.	0.	4.
		3.				
26	0		401.06	0.	0.	4.
		3.				
26	6		401.05	0.	0.	4.
		3.				
26	12		401.03	0.	0.	4.
		3.				
26	18		401.02	0.	0.	4.
		3.				
27	0		401.01	0.	0.	4.
		3.				
27	6		401.00	0.	0.	3.

FLOOD ROUTING STUDY
****

TIME DAY	HR	AVG.INFLOW CFS	RESERVOIR EL FT	MAIN SPILLWAY DISCHARGE CFS	OVERFLOW SPILLWAY DISCHARGE CFS	OUTLET DISCHARGE CFS
		3.				
27	12		401.00	0.	0.	3.
		3.				
27	18		401.00	0.	0.	3.
		3.				
28	0		401.00	0.	0.	3.

****

RESERVOIR ELEVATION WENT UNDER MINIMUM WATERSURFACE ELEVATION
AFTER 28 DAYS AND 0 HOURS

TOTAL INFLOW VOLUME 174. ACFT
TOTAL DISCHARGE VOLUME 362. ACFT

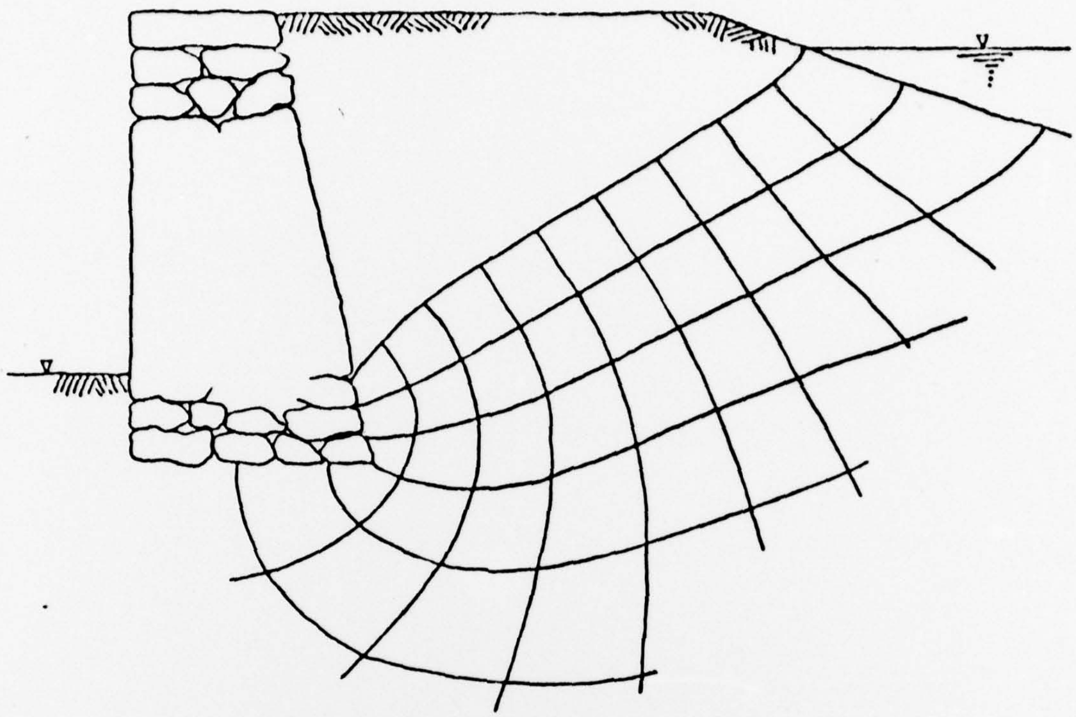
MAXIMUM WATER SURFACE ELEVATION 410.00 FT

MAXIMUM DISCHARGE THRU OUTLET CONDUIT 11. CFS

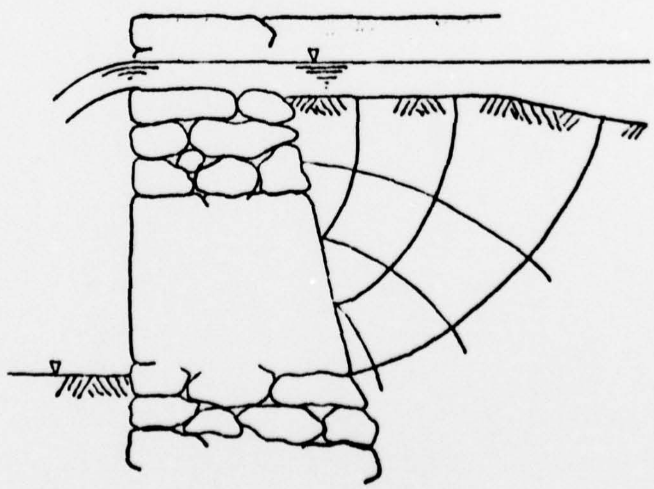
MAXIMUM TOTAL INFLOW 3. CFS
MAXIMUM TOTAL DISCHARGE 11. CFS

APPENDIX E

STABILITY CALCULATIONS



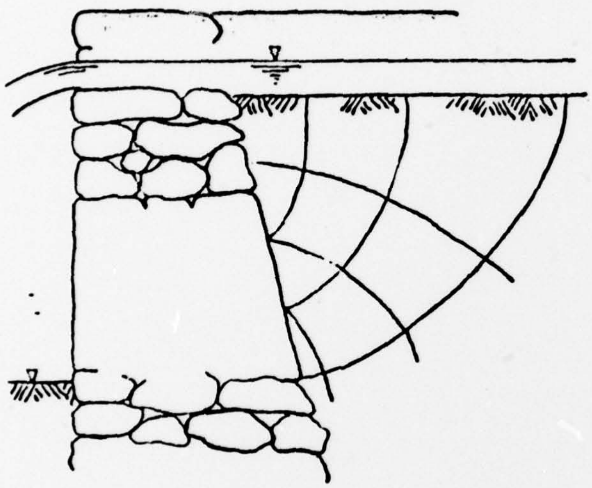
Seepage Pattern Through a Masonry-Faced Earth Dam

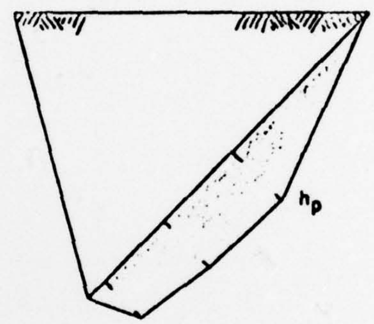


Seepage Pattern Behind a Spillway

Static Stability Analysis

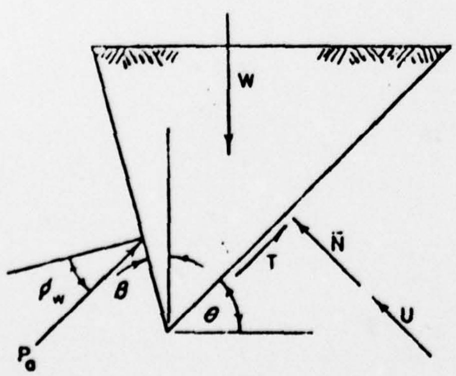
The trial wedge method was used to determine the active soil thrust against both the embankment and spillway walls.

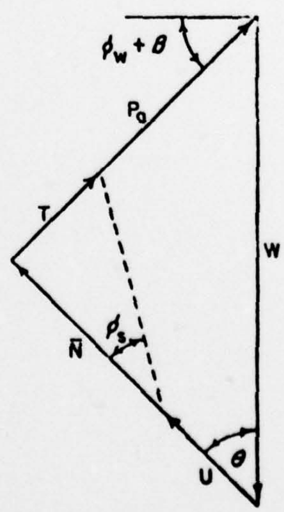




Trial Wedge

Seepage Pattern and Pressure Head Diagram for Spillway Wall





From the geometric relationship of the force polygon:

$$P_a = \frac{(W - U\cos\theta)\tan(\theta - \phi_s) + U\sin\theta}{\sin(\phi_w + \theta)\tan(\theta - \phi_s) + \cos(\phi_w + \theta)}$$

Based on the following assumptions driving and resisting moments were calculated about the ground surface at the base of the wall

Specific gravity of solids (G_s) = 2.7

Void ratio (e) = .45

Water content (w) of embankment soil = 10%

Saturation (S) of soil behind spillway = 95%

Internal angle of friction (ϕ_{soil}) = 33°

Angle of wall friction (ϕ_{wall}) = 33°

Total unit weight of wall (γ_{wall}) = 150 pcf[1]

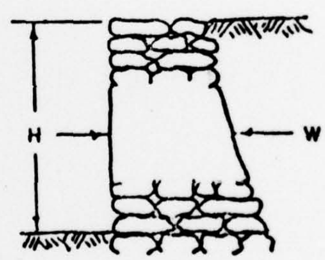
Coefficient of wall friction (μ_{stone}) = .7[2]

Factor Of Safety
For Embankment Wall

W/H Ratio	0.2	0.3	0.4	0.5	0.6
Overturning	1.3	2.2	3.4	4.9	6.7
Sliding	1.9	2.5	3.2	3.8	4.4

Factor Of Safety
For Spillway

W/H Ratio	0.2	0.3	0.4	0.5	0.6
Overturning	1.1	1.9	2.9	4.2	5.6
Sliding	1.6	2.1	2.6	3.1	3.6



Stability Analysis Results

1,2 Healy, Kent A. Evaluation and Repair of Stonewall-Earth Dams, Department of Civil Engineering, University of Connecticut, CE 74-84, December 1974

DETERMINATION OF FORCE ACTING AGAINST WALL:

ASSUME: $G_s = 2.7$ $\quad \omega = 10\%$ $\quad e = .45$ $\quad \phi_{soil} = 33°$ $\quad \phi_{wall} = 33°$

$$\gamma_T = \left(\frac{1+.1}{1+.45}\right)(2.7)(62.4 \text{ lb/ft}^3)$$
$$= 127.8 \text{ lb/ft}^3$$

ACTIVE THRUST BY TRIAL WEDGE METHOD

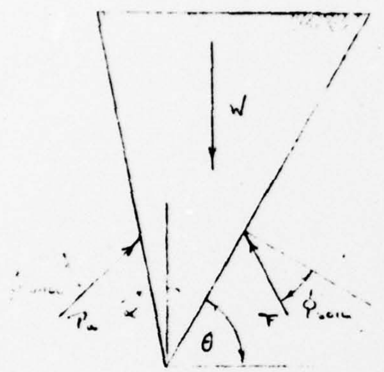


FIGURE 1

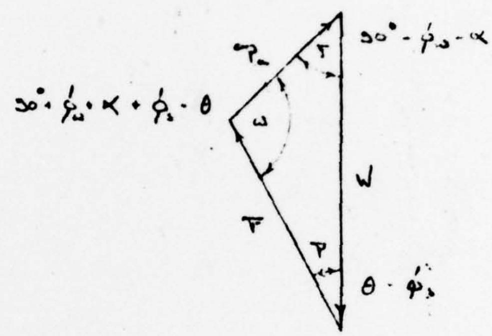


FIGURE 2

USING THE GEOMETRIC RELATIONS FOR THE FORCE POLYGON AND THE LAW OF SINES, ASSUMING $\alpha = 11°$

$$\angle \omega = 90° + 33° + 11° + 33° - \theta$$
$$= 167° - \theta$$

$$\angle F = 90° - 33° - 11°$$
$$= 46°$$

$$\angle P = \theta - 33°$$

θ	ω	$\sin\omega$	P	$\sin P$	W (lb/ft)	P_a (lb/ft)
47°-30'	119°-30'	.8704	14°-30'	.2504	7133.4	2052.1
50°-00'	117°-00'	.8910	17°-00'	.2924	6640.1	2173.1
52°-30'	114°-30'	.9100	19°-30'	.3338	6181.3	2267.4
55°-00'	112°-00'	.9272	22°-00'	.3746	5752.5	2324.1
57°-30'	109°-30'	.9426	24°-30'	.4147	5348.8	2353.2
60°-00'	107°-00'	.9563	27°-00'	.4540	4967.4	2358.3
62°-30'	104°-30'	.9682	29°-30'	.4924	4604.4	2341.7
65°-00'	102°-00'	.9782	32°-00'	.5299	4257.7	2306.4

MAXIMUM VALUE OF ACTIVE THRUST AGAINST THE WALL OF 2358.3 lb/ft OF WALL AT $\theta = 60°-00'$

ACTIVE THRUST BY COULOMB EQUATION (LAMBE & WHITMAN PG 178)

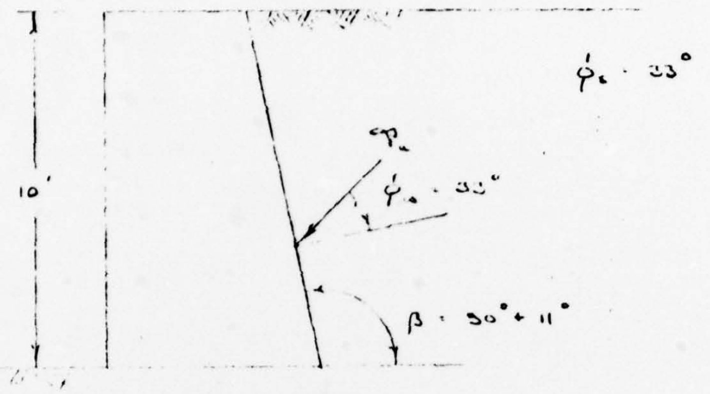


FIGURE 3

$$P_a = \tfrac{1}{2}(127.8\ \text{lb/ft}^3)(10\ \text{ft})^2 \left\{ \csc 101° \sin 68° \Big/ [\sin 134°]^{1/2} + \left[\sin 66° \sin 33° \Big/ \sin 101° \right]^{1/2} \right\}^2$$
$$= 6390.0\ \text{lb/ft} \left\{ 1.0187(.9272) \Big/ (.7193)^{1/2} + \left[.9135(.5446) \Big/ .9816 \right]^{1/2} \right\}^2$$
$$= 6390.0\ \text{lb/ft} \{ .3666 \}$$
$$= 2342.6\ \text{lb/ft}$$

DETERMINATION OF OVERTURNING MOMENT AND SLIDING OF WALL:

ASSUME $\gamma_{WALL} = 150\ lb/ft^3$ μ STONE ON STONE = .7

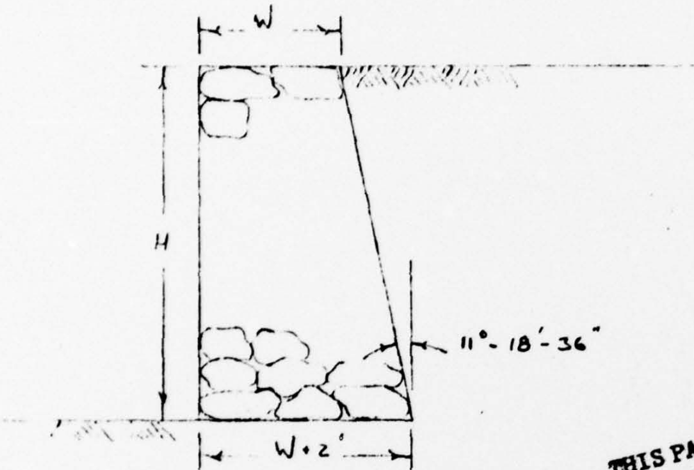


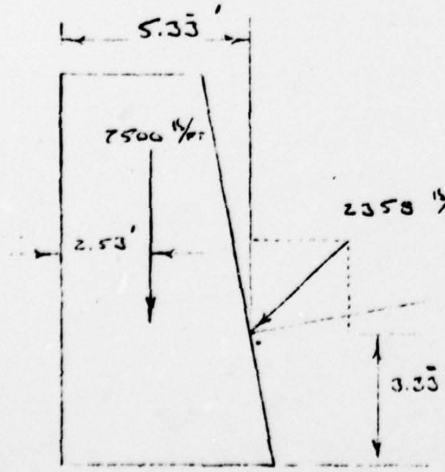
FIGURE 1

SAMPLE CALCULATION:

LET $W = 4'$, $H = 10'$; $W_{AVG}/H = .5$

TOTAL WEIGHT OF WALL $(W_w) = 150\ lb/ft^3\ [10\ ft(4\ ft) + \tfrac{1}{2}(10\ ft)(2\ ft)]$
$= 7500.0\ lb/ft$

MAGNITUDE AND LINE OF ACTION OF FORCES ON WALL



2358 lb/ft (VERT COMP. = 1638 lb/ft
HORIZ. COMP. = 1656 lb/ft)

CALCULATING MOMENTS ACTING ABOUT TOE OF WALL

TURNING MOMENT = 1696 lb/ft (3.33 ft)
= 5648 ft lb/ft OF WALL

RESISTING MOMENT = 7500 lb/ft (2.53 ft) + 1633 lb/ft (5.33 ft)
= 27706 ft lb/ft OF WALL

FACTOR OF SAFETY = 27706/5648
= 4.9

CALCULATING RESISTANCE TO SLIDING OF WALL AT BASE (GROUND SURFACE)

TURNING FORCE = 1696 lb/ft OF WALL

RESISTING FORCE = (7500 lb/ft + 1638 lb/ft) .7
= 6397 lb/ft OF WALL

FACTOR OF SAFETY = 6397/1696
= 3.8

TABULATED VALUES FOR FACTOR OF SAFETY

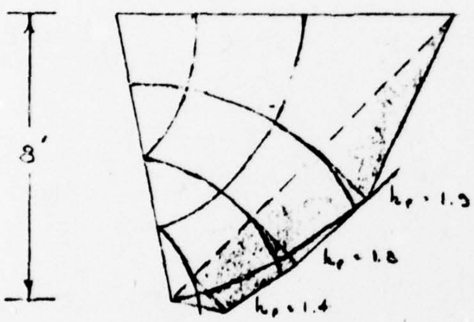
W_{AVG}/H RATIO	.2	.3	.4	.5	.6
OVERTURNING	1.3	2.2	3.4	4.9	6.7
SLIDING	1.9	2.5	3.2	3.8	4.4

DETERMINATION OF FORCE ACTING AGAINST SPILLWAY:

ASSUME: $G_s = 2.7$ $S = 95\%$ $e = .45$ $\phi_{soil} = 33°$ $\phi_{wall} = 33°$

$\gamma_T = (2.7 + .95(.45) / 1+.45)(62.4\ lb/ft^3)$
$= 134.6\ lb/ft^3$

SEEPAGE PATTERN & PRESSURE HEAD

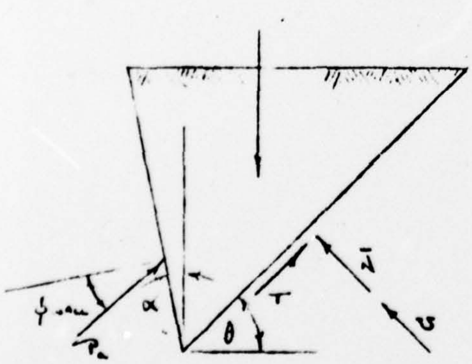


$\Sigma\, h_{P(AVG)} \Delta L = (.7FT)(1FT) + (1.6FT)(2.4FT) + (1.9FT)(2.8FT) + (1FT)(5.4FT)$
$= 15.3\ ft^2$

$U = 15.3\ ft^2 (62.4\ lb/ft^3)$
$= 955$

$\theta = 45°$

ACTIVE THRUST BY TRIAL WEDGE METHOD



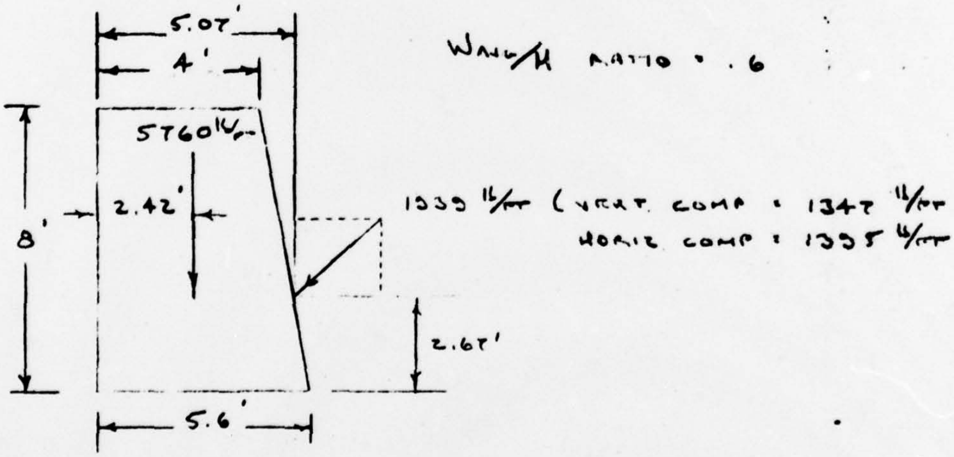
FROM THE GEOMETRIC RELATIONSHIP OF THE FORCE POLYGON

$P_a = \{(W - U\cos\theta)\tan(\theta - \phi_s) + U\sin\theta\} / \sin(\phi_w + \alpha)\tan(\theta - \phi_s) + \cos(\phi_w + \alpha)$

θ	W (lb/ft)	U (lb/ft)	P_a (lb/ft)
45°-00'	5163	955	1881
47°-30'	4803	830	1304
50°-00'	4475	768	1339
52°-30'	4167	686	1339
55°-00'	3878	624	1333
57°-30'	3605	574	1318
60°-00'	3348	499	1873
62°-30'	3104	437	1825
65°-00'	2868	381	1766

MAXIMUM VALUE OF ACTIVE THRUST AGAINST THE SPILLWAY OF 1339 lb/ft OF WALL AT ~ 50° - 52°

MAGNITUDE AND LINE OF ACTION OF FORCES ON SPILLWAY



CALCULATION OF MOMENTS ACTING ABOUT TOE AND RESISTANCE TO SLIDING OF SPILLWAY AT BASE SAME AS FOR EMBANKMENT.

TABULATED VALUES FOR FACTOR OF SAFETY

W_{AVG}/H RATIO	.2	.3	.4	.5	.6
OVERTURNING	1.1	1.9	2.9	4.2	5.6
SLIDING	1.6	2.1	2.6	3.1	3.6

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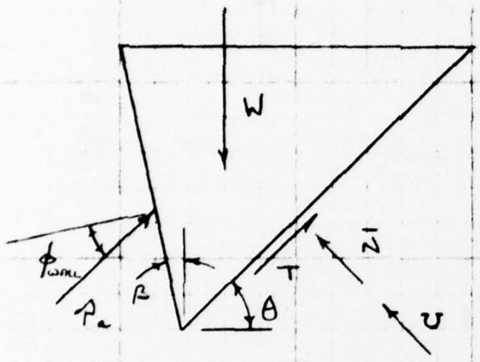
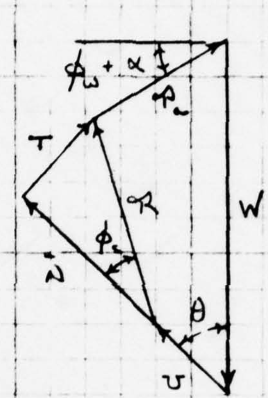
DERIVATION OF EQUATION — JOB NO. ______

BY DJK DATE ______

SOIL WEDGE



FORCE POLYGON



LET R BE THE RESULTANT EFFECTIVE NORMAL ($\bar{N}$) AND SHEAR FORCE (T) ACTING AT AN ANGLE ϕ_s (FRICTION ANGLE OF SOIL) FROM THE NORMAL TO THE SLIDING SURFACE

SUMMATION OF VERTICAL FORCES

$$P_a \sin(\phi_w + \beta) + R \cos(\theta - \phi_s) + U \cos\theta - W = 0$$

SUMMATION OF HORIZONTAL FORCES

$$P_a \cos(\phi_w + \beta) - R \sin(\theta - \phi_s) - U \sin\theta = 0$$

MULTIPLYING THE FIRST EQUATION BY TAN $(\theta - \phi_s)$ AND ADDING TO THE SECOND EQUATION ELIMINATES THE R EXPRESSION AND ALLOWS P_a TO BE EXPRESSED IN TERMS OF W AND U

$$P_a \sin(\phi_w + \beta) \tan(\theta - \phi_s) + P_a \cos(\phi_w + \beta) + U \cos\theta \tan(\theta - \phi_s) - W \tan(\theta - \phi_s) - U \sin\theta = 0$$

COMBINING TERMS YIELDS

$$P_a \left[\sin(\phi_w + \beta) \tan(\theta - \phi_s) + \cos(\phi_w + \beta) \right] - (W - U \cos\theta) \tan(\theta - \phi_s) - U \sin\theta = 0$$

SOLVING FOR P_a

$$P_a = \frac{(W - U\cos\theta)\tan(\theta - \phi_s) + U \sin\theta}{\sin(\phi_w + \beta)\tan(\theta - \phi_s) + \cos(\phi_w + \beta)}$$

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This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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